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The Journal of the American Welding Society

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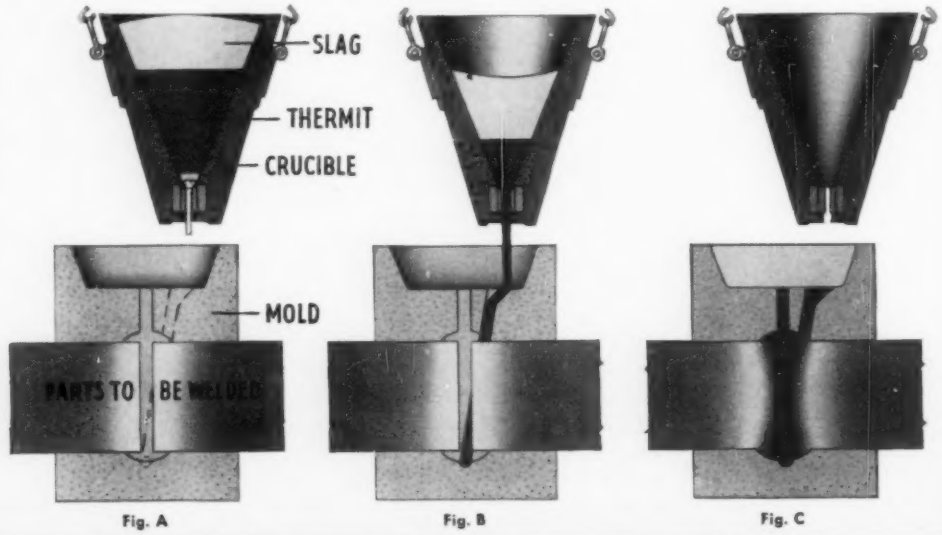

Fig. A Fig. B Fig. C

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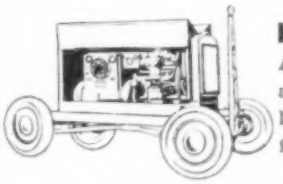

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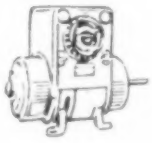

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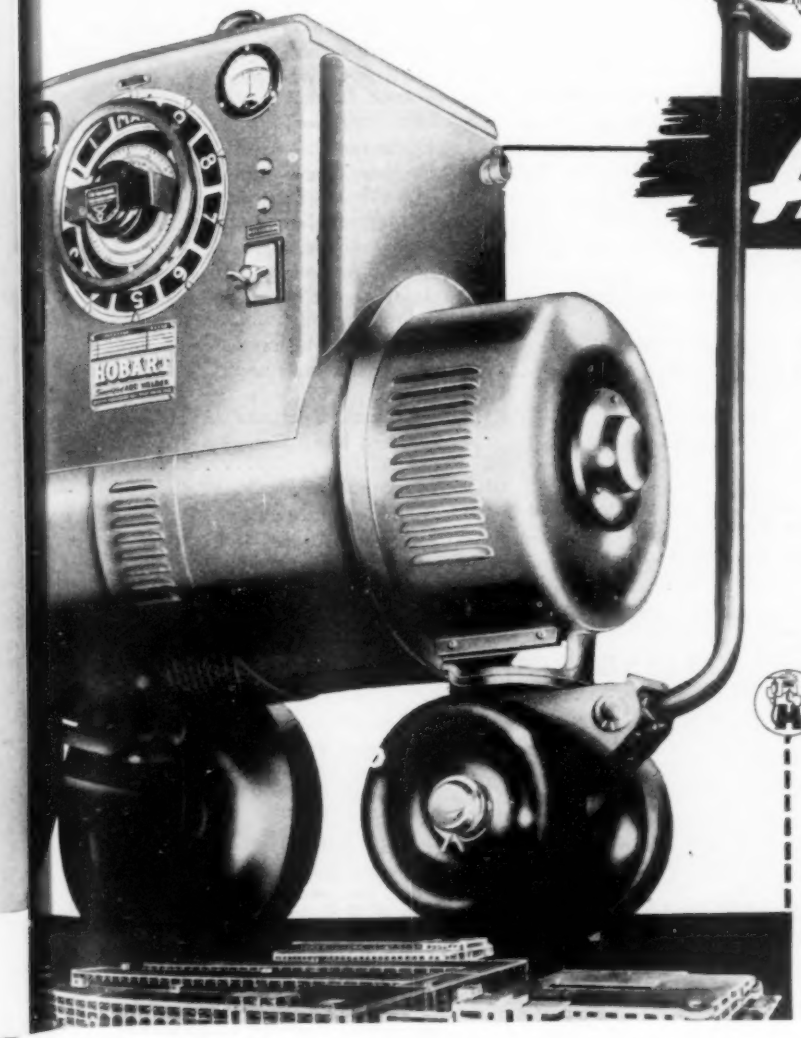

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Published for the Advancement of the Science and Art of Welding

W. SPRARAGEN, Editor

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COVER

Welding a Bed Plate at the East Pittsburgh Works of the Westinghouse Electric Corp.

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Subscriptions $5.00 per year in United States and possessions: Foreign Countries $7.00. Single copies, non-members $.75; Special issue October $1.00; members 50 cents.

Entered as second-class matter January 15, 1932, at the post-office at Easton, Pa., under the act of March 3, 1879.

PUBLICATION OFFICE
20th & Northampton Streets, Easton, Pa.
EDITORIAL AND GENERAL OFFICES
33 West 39th St., New York 18, N. Y.

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The Journal of
The American Welding Society
VOLUME 26 · NUMBER 1 · JANUARY 1947

Heavy-Cutting Applications in Foundry and Steel Mill*

By R. S. Babcock†

THE urgency for increased production in heavy industry during the war placed considerable importance on developing ways and means of reducing handling and processing time for large steel castings, forgings and ingots. Oxygen cutting was used wherever possible to remove excess material such as risers and hot tops. This process was aided through the development of improved apparatus for cutting normal thicknesses of steel and through the designing of machine-borne oxy-acetylene cutting apparatus of greater capacity for severing thicker sections than had heretofore been cut.

The C-45 blowpipe, capable of cutting steel 66 in. in thickness, was developed during the early stages of this period to meet increasing field demands for such apparatus. Preliminary models have replaced previous methods of lancing, sawing, drilling and blasting for severing large steel sections in many foundries, steel mills, forge shops and shipyards. The introduction of the blowpipe reduced the operating time to a small fraction of that previously involved, so that increased war production could be maintained. This paper describes some of the successful applications of this blowpipe.

The reduction in time spent in processing large steel parts on slow-moving heavy machinery, such as presses and planers, contributed to meeting the high production schedules set up to assist the war effort. Today the high amortization and maintenance costs of heavy machinery are important factors in production costs and any means of reducing these costs helps manufacturers meet the competition of production and price in the postwar era.

The relative size of the C-45 blowpipe and nozzle can be judged from the photograph in Fig. 1, where it is shown beside a standard 36-in. scale. The cutting-oxygen tube in the blowpipe has a larger internal diameter than the bore of the largest C-45 nozzle, is centrally located, and extends straight through the blowpipe, so it will smooth out the turbulence in the gas stream that is created when the gas passes through hoses and connections.

A pressure gage attached to the blowpipe body and connected to the cutting-oxygen passage provides an accurate means of measuring the pressure at that point. It should be noted that there is no cutting-oxygen valve in the blowpipe and provision is normally made to control the flow from a position more convenient to the operator by mounting a quick-acting shut-off valve on the supporting cutting machine at a location adjacent to the starting switch. Throttle valves for preheat gases are located on the rear body of the blowpipe. These

Fig. 2—Oxweld Nozzle, Series Nos. 1701, 1401, 1501 and 1601

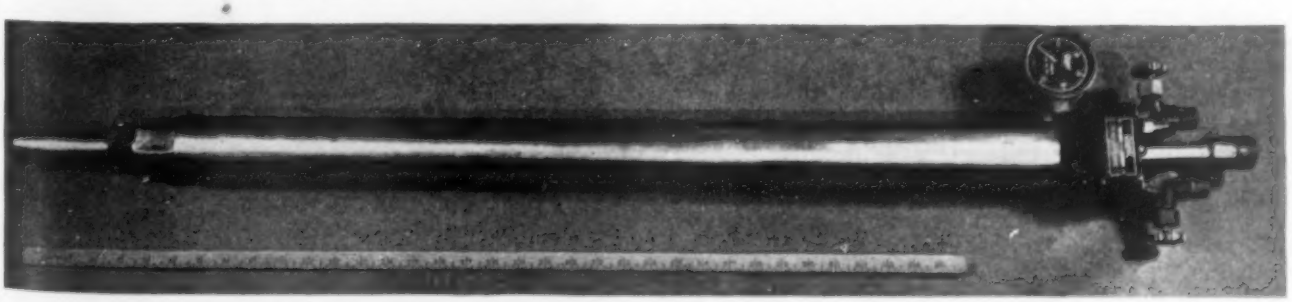

Fig. 1—C-45 Blowpipe, Side View

* Presented at the Twenty-Seventh Annual Meeting, A.W.S., Atlantic City, N. J., week of Nov. 17, 1946.
† Development Engineer, The Linde Air Products Co., Newark 5, N. J.

Fig. 3—Cutting Chart—C-45 Blowpipe and 1701 Series Nozzles

Thickness, In.	Nozzle Size	Gas Pressures* Oxygen, Psi.	Gas Pressures* Acetylene, Psi.	Gas Flows Oxygen, Cu. Ft./Hr.	Gas Flows Acetylene, Cu. Ft./Hr.	Flame Length, In.	Cutting Speed, In./Min.
16–22	20	35	10	1500	136	5/8	3–4
22–24	25	30	10	1600	180	5/8	3–4
24–26	30	22	10	2160	213	5/8	2–3
26–28	35	20	10	2820	237	5/8	2–3
28–30	40	18	10	3500	272	5/8	2–3
30–35	45	16	10	4250	302	5/8	2–3
35–40	50	12	10	4600	330	1/2	2–3
40–45	55	9	10	4950	365	1/2	2–2 1/2
45–50	60	7	10	5450	383	1/2	2–2 1/2

* Cutting oxygen pressure measured at the blowpipe. Acetylene pressure measured at the regulator.

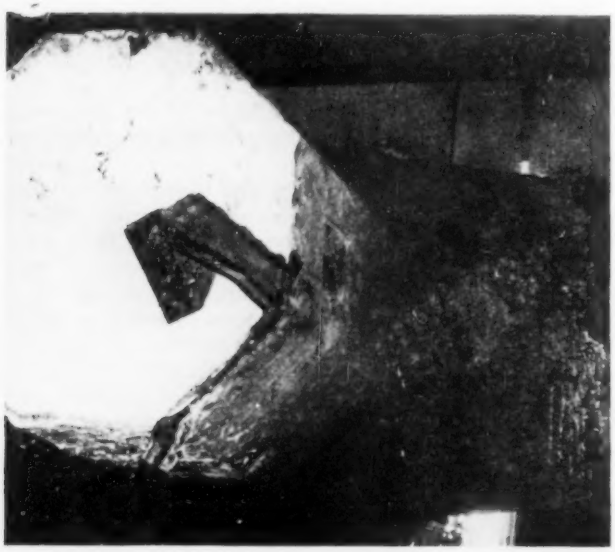

Fig. 4—Cutting Through 553,000-Lb. Ingot

valves, together with the twin preheat mixers, provide for a high flashback resistance even with acetylene flows ranging up to 400 cu. ft. per hour at the gas pressures that are available in standard pipe lines fed from generators or manifolded cylinders. Auxiliary valves may be provided on the machine for greater accessibility during the operation of the apparatus on hot material. Connections are provided on the blowpipe for water cooling during cutting operations on large sections of steel at rolling or forging temperatures.

The one-piece copper nozzles in nine sizes, having bores ranging from 0.200 to 0.600 in., are designed "to take it" during the conditions encountered by the apparatus. They are of such size and contain such a large number of preheat passages (16 in the larger sizes) that fabrication would be prohibitive except by the swaging process currently employed in their manufacture. A close-up of a No. 55 size nozzle is shown in Fig. 2 in comparison with three other styles of standard nozzles.

One of the outstanding features in the use of this apparatus is the reversal of the theory of using higher oxygen pressures for increases in material thickness as practiced with smaller blowpipes on material less than 20 in. thick. While larger nozzles are employed for increases in material thickness, the optimum blowpipe oxygen pressure decreases steadily with increases in nozzle size, reaching a low of 7 psi. for successful operation on material over 4 ft. thick with the largest nozzle. This is clearly indicated in the chart of recommended operating conditions shown in Fig. 3. When oxygen pressures higher than those specified are employed, the oxygen stream develops one or more points of turbulence after leaving the nozzle, which materially reduces the depth that the reaction zone will carry through cold steel. In a few cases slightly higher pressures have been used to better advantage on hot steel. This operating technique is contrary to earlier practices in which pressures as high as 150 psi. were required to force sufficient oxygen through the nozzles and blowpipes to sever material up to 30 in. thick, which is only half of the maximum capacity of the new model. Because of the greater stability of the reaction zone produced by this blowpipe, it is possible to cut vertically or horizontally equally well, and the selection of the plane of cutting depends solely upon the ease of supporting or locating the material to be cut.

This blowpipe has been used to cut off hot-top ends from ingots of various sizes, including some of the largest ever poured. The photograph in Fig. 4 shows a cut progressing through a 553,000-lb. triple-pour armor plate forging ingot with a cross-sectional thickness ranging from 60 to 66 in. A No. 60 nozzle, with an oxygen pressure of 15 psi., cut at the rate of 2 1/2 in. per minute through this armor plate material, preheated to 1500° F. Owing to the extreme heat prevailing in the cutting area, which was directly in front of a partially opened furnace door, the mechanization of the cutting process vastly

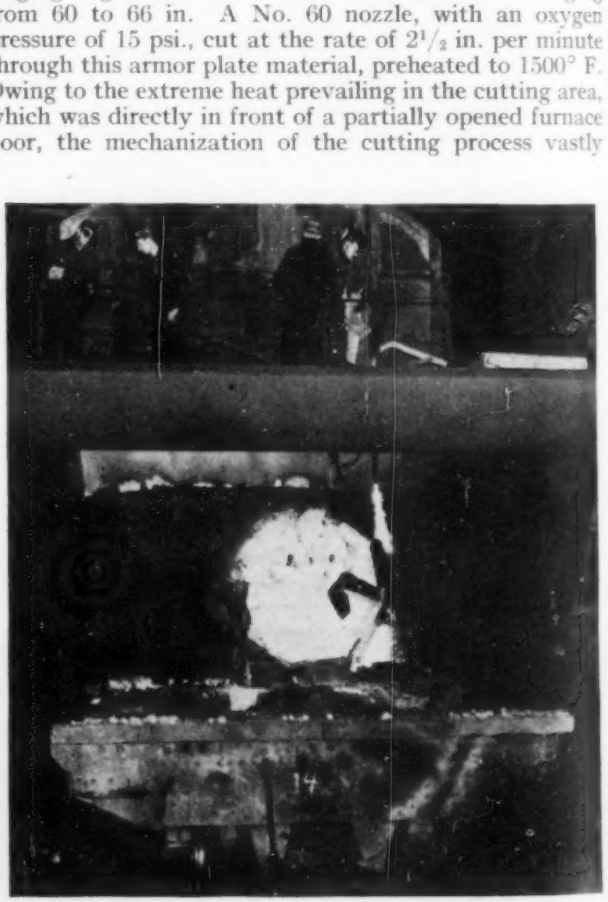

Fig. 5—Cutting Location, 553,000-Lb. Ingot

Fig. 6—Surface of Cut, 553,000-Lb. Ingot, 60–66 In. Thick

improved the working conditions that the operators had to withstand. Figure 5 shows the cutting location following the completion of the cut with the ingot mounted on the furnace car and the cutting machine located on a 5-in. plate. This plate, supported above and in front of the open furnace, served as a working platform.

Previously, three crews of trained operators severed this section in 10 to 20 hr. of lancing time and operated in rotation for 15-min. periods. With the C-45, operating time totaled only $1^1/_2$ hr. The change to mechanized cutting not only reduced operating time, improved working conditions for the operators and produced a smoother end surface on the ingot, but also reduced the oxygen consumption to approximately one-third of that previously involved. Figure 6 is a close-up of the cut surface on the hot-top end after it had been removed from the ingot. Considerable lag developed in the second half of the cut when a smaller size cutting nozzle was tried; lancing was required to complete the severing operation.

The C-45 blowpipe has also been used to section ingots longitudinally for metallurgical inspection. Figures 7 and 8 show two views of a trial cut preliminary to such a sectioning operation on a 35,000-lb. gun barrel forging ingot of modified S.A.E. 4140 composition. The sketch in Fig. 9 indicates the thickness of the material encountered in removing a 3-in. thick slab containing the desired center section. This ingot was cut at 900° F., using a No. 40 nozzle at 10 lb. oxygen pressure and at a speed of $3^3/_8$ in. per minute. The adverse conditions presented at the start, at the junction of the hot top and the cavities and pipe of hot top, increased the cutting time to approximately 75 min. for each pass. The uniformity of the kerf surfaces and thickness of the slice removed reduced the final machining time to such an extent that the saving in the cutting of a single ingot was sufficient to offset the cost of the entire cutting equipment. This operation was previously disclosed in the American Institute of Mining and Metallurgical Engineers Technical Publication No. 1720, entitled "Segregation in a Large Alloy Steel Ingot," by S. W. Poole and J. A. Rosa, of the Republic Steel Corp. This method of ingot sectioning for metallurgical inspection has been used on both small and large alloy ingots of NE 4720, S.A.E. 3312 and S.A.E. 4340 composition, with an average saving of 80% of the machining time.

Because of the extremely smooth cuts obtained with this apparatus, it is possible to replace cold sawing for etch-test samples on large rolled or forged blooms. With

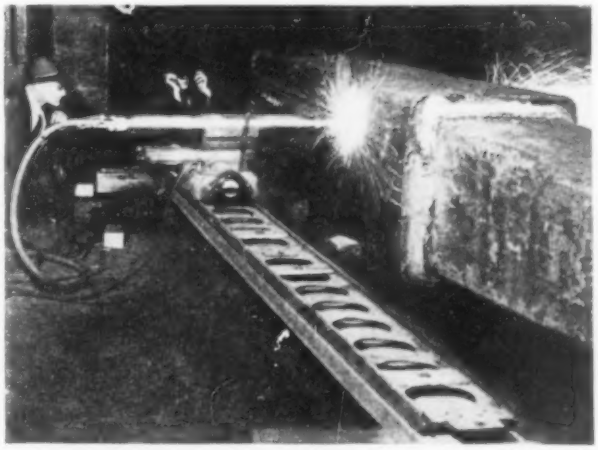

Fig. 8—Horizontal Cut, 35,000-Lb. Ingot, Side View

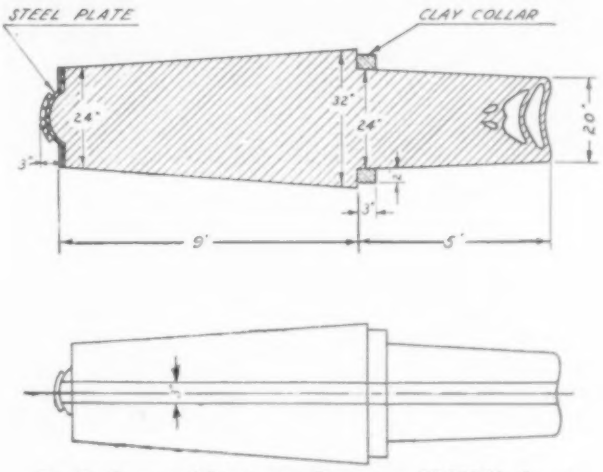

Fig. 9—Layout of Sectioning Operation, 35,000-Lb. Ingot

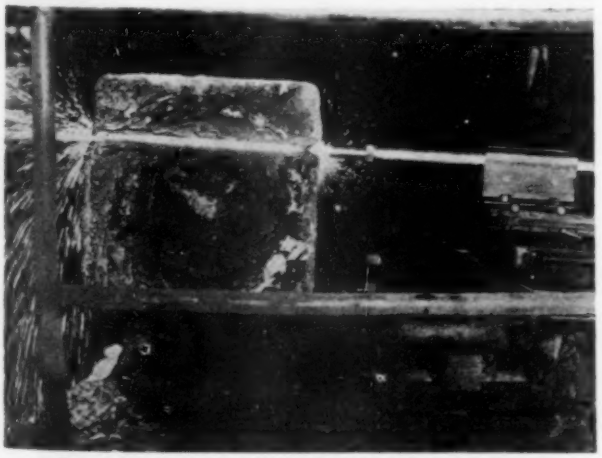

Fig. 7—Horizontal Cut, 35,000-Lb. Ingot, End View

variations of less than $^1/_8$ in. in thickness, samples 1 in. thick have been sliced from sections up to 30 in. thick; and these required only a small amount of grinding to prepare the surfaces for deep etching in determining the presence of cracks, segregations, pipes and other defects. Figure 10 shows a close-up of a cut surface obtained when a defective ingot that had been partially forged was being scrapped. The 26-in. square section was cut with a No. 40 nozzle, with an oxygen pressure of 22 psi. and at a cutting speed of 2 in. per minute.

The C-45 blowpipe was employed by a shipyard in connection with the preparation of rudder support castings required in the fabrication of some of our largest naval vessels. Past experience had shown that large rudder support castings could be successfully poured only by including the gudgeon section with the post-

supporting ends of the casting, in order to prevent locked-up stresses from cracking the material during cooling. The sketch shown in Fig. 11 indicates a sequence of six cutting movements made with a straight-line portable cutting machine in removing the gudgeon section. The C-45 blowpipe was inclined backwards during transverse operations and at a bevel angle of $36^1/_2°$ from the vertical during longitudinal passes. While the average thickness cut was between 24 and 27 in., at some points the reaction zone extended through 40 in. of steel. The intersection of the straight-line cuts was made into $1^1/_4$-in. diam. holes drilled at the proper angle, which aided in the reduction of stresses at this point and facilitated the lining up of the apparatus. This material was approximately

Fig. 10—Close-Up of Cut Surface, 26-In. Forged Section

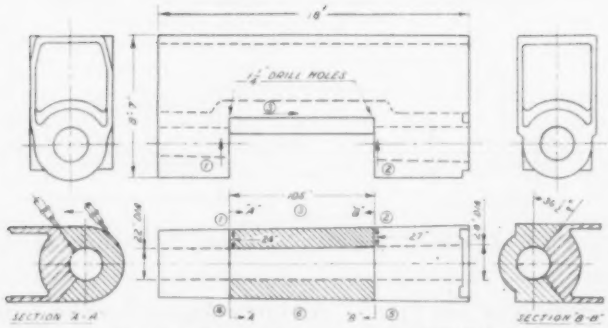

Fig. 11—Layout of Cutting Operation on 100-Ton Casting

0.35 carbon and, because of its extreme size and value, was preheated to 500° F. prior to the severing operation. The subsequent use of these parts was entirely satisfactory and completely justified this method of fabrication.

A slow boring operation, required in machining rings $19^1/_2$ in. O.D. by $10^7/_8$ in. I.D. and 32 in. long from forged rounds, has been replaced by the combination of lancing and circular cutting with the C-45 blowpipe. A starting hole $1^1/_2$ in. in diameter is lanced lengthwise through the center of each solid round, and then an $8^1/_2$-in. I.D. section is cut out with the C-45 blowpipe mounted on a CM-12 shape-cutting machine. This leaves only 1 in. to be machined from the inside diameter of the ring. Between 18 and 23 machine hours are saved by using this flame-cutting method.

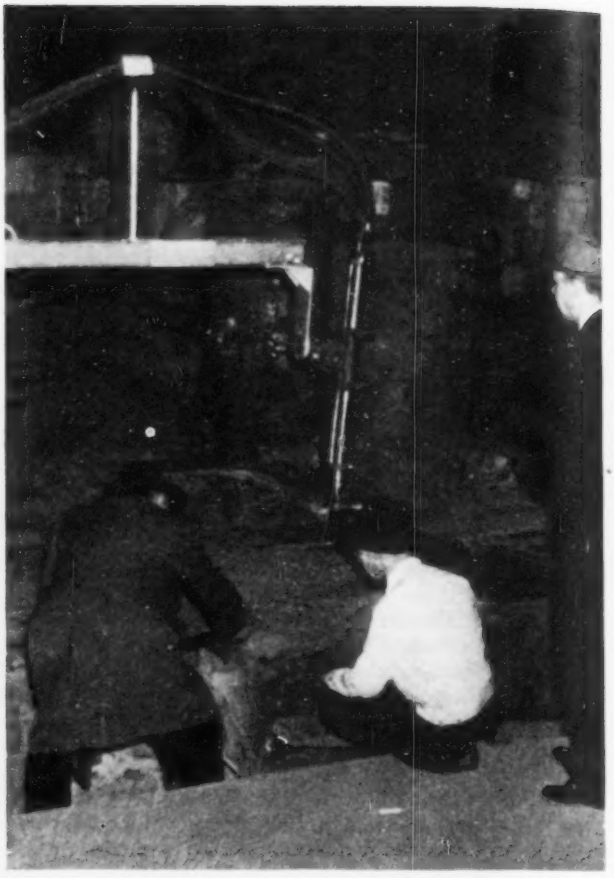

Fig. 12—Riser Removal—Large Engine Base Casting

The removal of large risers from steel castings has been accomplished by using the C-45 blowpipe in several foundries. This work previously required the use of lancing, drilling, milling or other types of machining, and elaborate sequences of operation were employed to prevent failure due to cracking when the residual stresses in the casting were relieved by the removal of the riser. It has been found that very satisfactory results can be

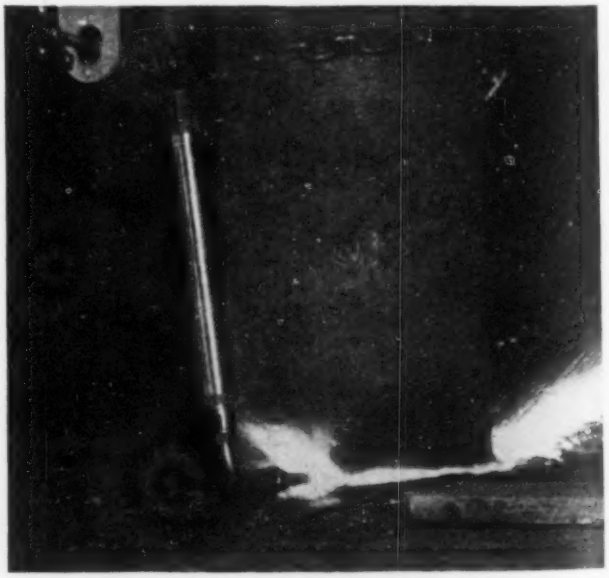

Fig. 13—Close-Up Riser-Cutting Operation

Fig. 14—Surface Left by Riser-Cutting Operation

obtained by cutting the riser from the casting with a machine-borne C-45 blowpipe while the material retains some of its original heat. The uniform movement of the machine produces smooth-cut surfaces, and the slow uniform rate of progression of the heat generated by the large cutting reaction helps to prevent cracking when the risers are severed. Because of the control the operator has over the direction of the oxygen stream, it is possible to cut closer to the casting surface and, consequently, reduce or eliminate the need for subsequent grinding or machining in the removal of riser pads.

Risers ranging up to 45 in. by 72 in. have been cut off horizontally prior to the removal of the casting from the pouring pit, and with only the riser and top surface of the casting exposed. The riser is cut off while the material temperature is at 400 to 500° F., and, by immediately covering over the casting with a layer of mold sand, the heat of the casting tends to draw the material adjacent to the cut surface, so that there is no failure during subsequent operation of the part. Figure 12 shows the setup used in removing a series of twelve risers from a large machine base casting. The cutting operation is shown in Fig. 13 while Fig. 14 shows the cut surface, which was close enough to the casting surface so that further trimming was unnecessary.

Hot-top removal from large carbon- and alloy-steel ingots is a standard practice in several mills in providing

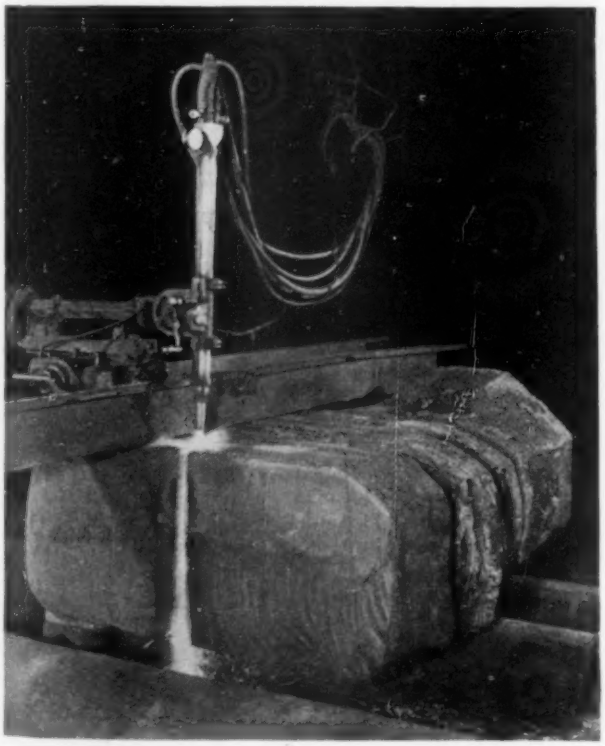

Fig. 15—Reducing Hot-Top Section to Charging Box Size

Fig. 16—Continuation of Operation Shown in Fig. 15

such material for domestic and foreign consumers, since this permits shipment of the usable steel only. Severing by cold sawing requires several hours' time, and in cases where the material thickness exceeds the effective range of the saw blade, it is necessary to reposition the material one or more times to complete severing. Cold-sawing has been effectively replaced in mills employing the C-45 blowpipe, and the severing time has been reduced to minutes instead of hours.

It has also been established that hot-top ends that have been left on ingots to facilitate manipulation during the forging of large crankshaft blanks, propeller shafts and similar material can be reduced to furnace-charging sizes by heavy-cutting apparatus. The hot-top ends are generally partially forged down in the press following completion of the ingot-forging operation. The C-45

blowpipe, with its lower initial investment, provides a means of decreasing the cost of severing and reduction to charging-box size in place of knifing on the press. A large press represents a much higher investment and operating cost, so that it is of paramount importance that press time be kept at a minimum in order to make the forging operation profitable.

The photographs in Figs. 15 and 16 show two steps in cutting up the hot-top end from a 26-in. thick crankshaft forging blank. The cut surface in the foreground of Fig. 15 shows that the cutting time had been held to a minimum by using a high cutting speed during the first part of the cut and gradually slowing down during the latter portion of the cut to effect complete severing. The view in Fig. 16 shows the passage of the longitudinal cut through the second cross cut on the way toward the third cross cut and the hot-top end itself. The racking mechanism in the blowpipe permits raising the cutting nozzle to clear the unforged hot-top end. The continuous cutting operation of the C-45 blowpipe has been well

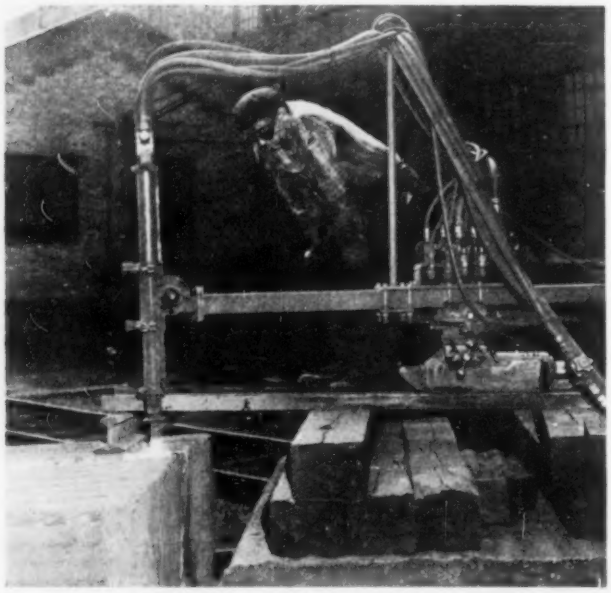

Fig. 17—Ingot Cutting Arm with C-45 Blowpipe

received by this plant in replacing smaller blowpipes with which it was necessary to assist with lancing in jumping across pipes and hot-top sink holes. With the C-45, gaps in material up to 3 in. have been successfully bridged by the reaction zone cutting through material up to 30 in. thick.

In the reduction of off-heat and other types of scrap ingots to furnace-charging sizes, it is now standard practice in several mills to use a mechanized cutting rig with the C-45 blowpipe. This replaces the slower oxygen lancing and the more hazardous blasting processes that are more costly methods of reclaiming such steel. Over 60,000 tons of scrap steel ingots have been reclaimed by one mill at the rate of 140 tons per day, using 110 cu. ft. of oxygen per ton on ingots ranging from 32 to 55 in. thick. Previously, the same operation required 320 cu. ft. oxygen per ton for lancing at an average rate of 25 ton per day. Figure 17 shows a typical heavy-cutting setup in operation severing a 34-in. thick scrap ingot. Figure 18 is an end view looking into the kerf and also illustrates the type of cut surface produced by rapid severing, as evidenced by the previous cross cut. Figure 19 shows a cut being made through a 48-in. thick section simulating an ingot of this size. This type of work has been successfully used on ingots up to 56 in. thick.

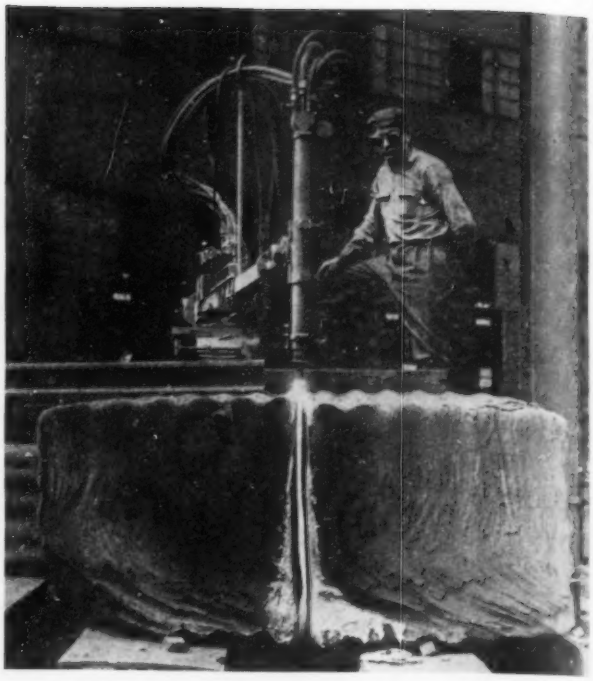

Fig. 18—Cutting 34-In. Thick Ingot

Over 30,000 tons of thimble butts and ladle skulls have been reduced to charging-box size at the rate of 60 tons per day and at a cost of $2.50 per ton using the C-45

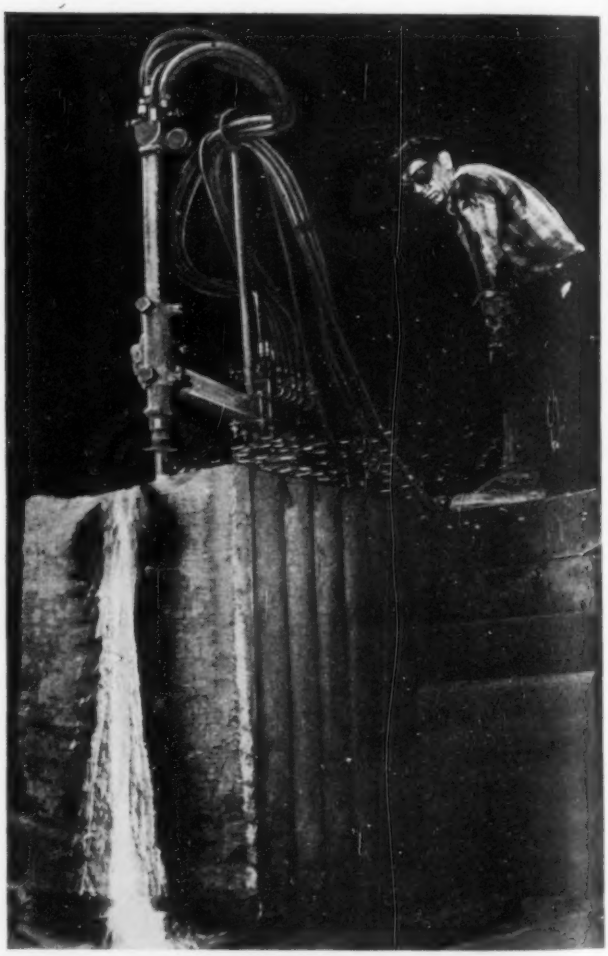

Fig. 19—Cutting 48-In. Thick Section of Scrap Ingot

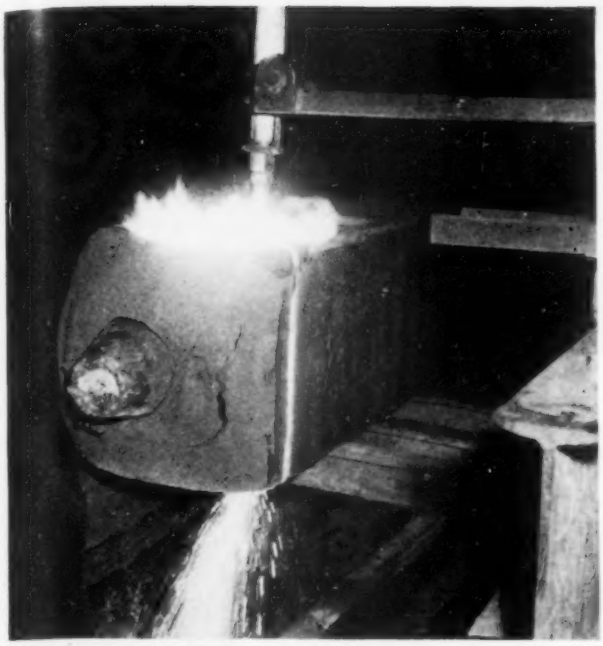

Fig. 20—Cutting Hot Die-Block Steel 26 In. Thick

blowpipe. Lancing this material would have cost $4 per ton at a rate of 20 tons per man-day. In another location skulls, spills and scrap, previously dumped because of the high cost of reclaiming, have been cut up with the C-45 blowpipe at a cost of $2.80 per ton, because of the higher cutting speeds attainable with this apparatus.

More recently it has been found possible to use the C-45 blowpipe in conjunction with the powder-cutting process to reclaim successfully low-grade steel skulls, ladle buttons and spills. Powder cutting permits mechanization of the operation in cutting through layers of slag and iron to depths of 32 in. so that the subsequent severing by dropping a skull-cracker ball is a rapid means of reducing these sections to furnace-charging size. The powder-cutting process is more completely described in a paper being given at another session by Mr. D. H. Fleming.

Many unusual applications have developed after the C-45 blowpipe has been installed to handle standard heavy-cutting operations. These include shape cutting, shape planing, cutting up bundles of scrap 4-in. diam. bar stock into furnace-charging sizes, and squaring the ends of die block material after it is forged from ingots. The latter is shown in Fig. 20, in which a 26-in. square section of steel of Finkl Die Block quality, forged down from a 41-in. ingot, is being cut with a No. 50 nozzle, with an oxygen pressure of 11 psi. and a cutting speed of 3 in. per minute. The material could have been sheared or knifed to length on the press, since it still retained forging heat of 1600° F. However, square ends were specified, and the C-45 provided a satisfactory means of cutting the ends square, as evidenced by the end view in Fig. 21. An interesting angle of this job was the use of a highly carbonizing flame after the cut had been started, thereby preserving a square top edge.

The C-45 heavy cutting blowpipe and nozzles were originally designed and developed for use with oxy-acetylene preheat, but steel sections upwards of 40 in. in thickness have been successfully severed by use of suitable cutting nozzles prepared for and used with oxy-natural gas and oxy-propane. The selection of the preheat gas has been based on the available supply in different mills rather than upon relative merits of the gases as a preheating medium.

The high gas flows that are necessary in the successful operation of this and other heavy-cutting equipment can be met with pipe lines or manifolded cylinders, provided regulators, hoses and station equipment of an adequate size are installed to supply the demand rates.

In addition to the spectacular nature of heavy-cutting application, past and current uses of the C-45 blowpipe have established the fact that this apparatus provides a practical and economically sound method of severing large sections of steel.

Fig. 21—Cut Surface, 26-In. Thick Bloom

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A New Stick Feeder Welding Apparatus*

By Dr. Joseph M. Tyrner†

Introduction

MANUAL arc welding is recognized as a most versatile construction and fabrication tool because of its unmatched simplicity. There is hardly any other tool as simple and yet as versatile as the electrode holder. A skilled operator using a standard holder is able to join two pieces of metal even under conditions of poor fit up. Since it is a manual operation, however, much of the performance and reliability of the welded joint depends upon the welder.

Automatic welding, which does away with much of the human element, has progressed during the years but this process has been limited by economical rather than technical considerations as compared to the simple manual process. Ordinarily the automatic process requires a large number of repetitive joints to justify the high initial cost of necessary jigs, fixtures and the other equipment. Arc welding is a process which is used by many small jobbing shops as well as by large fabricators. Even for repetitive operations the small shops often cannot afford elaborate apparatus especially since it is also possible to do the same kind of work with as simple a tool as the electrode holder.

A New Stick Feeder Welder

This new device is an attempt to enlarge the field of automatic welding. It was designed to be a tool which could do all a welder can do and yet be as simple and compact a piece of equipment as possible. It is self contained, portable and extremely simple to set up. It feeds the electrode into the arc maintaining by automatic means a proper arc length and it also moves the arc spot along a predetermined path to lay down a bead.

The device is shown in Fig. 1. Essentially it consists of an inclined tube (*A*), along which a carriage (*B*) is propelled by a motor. The electrode is fastened to the carriage (*B*) by means of an electrode holder (*C*). As the electrode burns down, the carriage moves along the tube with the proper speed to hold the desired arc length. The inclination of the tube is arranged so that one component of the carriage movement takes care of the electrode burnoff, while another component is used to lay down the bead. The angle between electrode and bead as well as the inclination of the tube (*A*) may be changed to obtain the desired welding condition.

The drive motor for the carriage propulsion is in the box (*D*). This box (*D*) is mounted on a double base (*E*). The plane of electrode and tube (*A*) is adjustable. A guide bar (*F*) carried by the base guides the electrode while the bead is deposited. This bar is adjustable to align the arc path with the location of the joint.

The propulsion of the carriage is achieved by a series motor connected to the arc voltage. A series motor, used under the conditions met in this device, operates

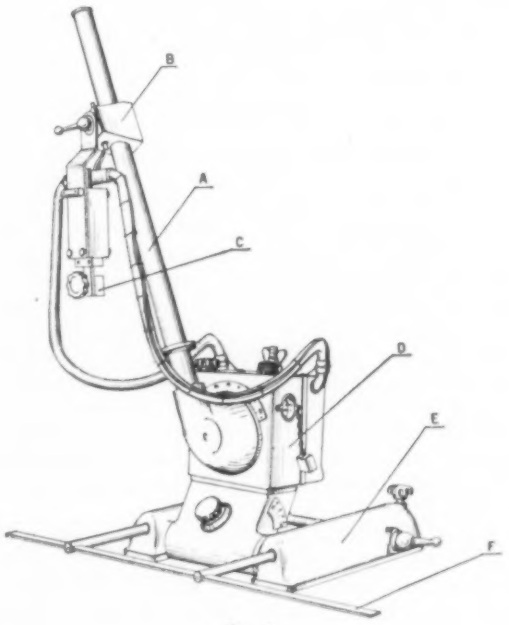

Fig. 1

at a speed proportional to the impressed voltage which may be a. c. or d. c. Only a series motor offers this advantage.

In conventional automatic heads the starting of the arc is achieved by reversing the electrode drive rollers. When the operation is started, the electrode moves down until it touches the work piece. The drive then stops and by reversing withdraws the electrode to a proper arc gap. When the arc is burning the drive resumes its forward movement at a controlled speed to maintain the desired arc voltage. This procedure necessitates a very responsive feeding mechanism because the time available to establish an arc is very short, not longer than about 40 milliseconds. If the electrode is not withdrawn immediately after making contact it freezes to the work piece.

* Presented before Twenty-Seventh Annual Meeting, A.W.S., Atlantic City, N. J., week of Nov. 17, 1946.
† Apparatus Research Dept. Air Reduction, New York.

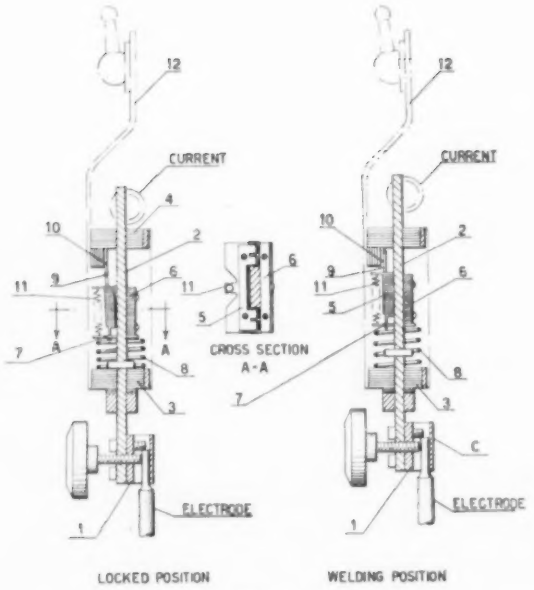

Fig. 2

The apparatus presented here solves this problem by using a separate device to start the arc. This device is shown in Fig. 2.

The electrode chuck (*1*) is fastened to a bus bar (*2*) which is free to move about one quarter of an inch axially in the two guides (*3*) and (*4*). The bus bar is encompassed by two iron cores (*5*) and (*6*). (*6*) is rigidly connected to the bar but (*5*) is pivoted in (*7*). When the bus bar is pulled down against spring (*8*) pin (*9*) falls into the grove (*10*) because spring (*11*) pulls core (*5*) away from core (*6*). That keeps the bus bar in the lower or "cocked position." When the electrode is brought into contact with the work piece, a current surge flows through the welding circuit. The magnetic field around the bus bar pulls the two cores (*5*) and (*6*) together and forces pin (*9*) out of grove (*10*). The bus bar is freed from its restraint and is thrown upward by spring (*8*). The electrode in the electrode holder (*1*) is withdrawn from the work piece and an arc is established. The release of the bus bar and the jump of the electrode is practically instantaneous. This makes certain that an arc is established and that the electrode does not freeze to the work piece.

The device is mounted on the bracket (*12*) which is fastened to the carriage (*B*) shown in Fig. 3 which, in turn, moves on tube (*13*). Inside of this tube is a threaded shaft (*14*) driven by the motor (*15*). A ratchet type half nut (*16*) forced into engagement with the shaft

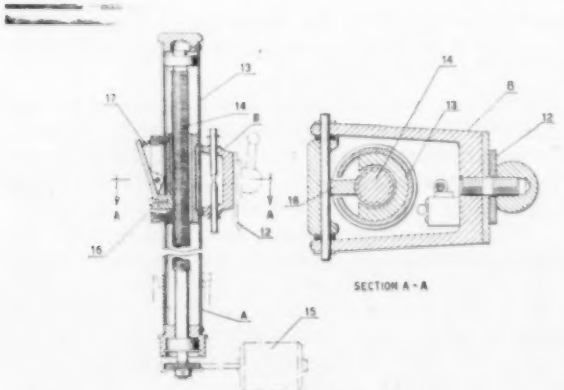

Fig. 3

(*14*) by spring (*17*) couples the carriage (*B*) to the motor. Thus the carriage runs down on the tube according to the speed of the motor.

It has been mentioned before that the drive motor is a series motor. It can easily be shown that for an arc voltage E impressed on the drive motor the carriage speed b_a becomes

$$b = K_1 E - K_2 (r + R)$$

where K_1 and K_2 are constants, r is the resistance of the drive motor and R is a variable series resistance through which the apparatus is controlled. This formula is developed in the appendix. In Fig. 4 three lines for three values of the control resistance are shown. On this diagram is drawn the burn-off rate of an electrode. This curve depends not only on the electrode but also on the static characteristic of the welding generator. The point of intersection of the motor line and the burn-off curve is the operating point of the welder. E_a is the arc voltage encountered and b_a the corresponding burn-off rate.

If a higher arc voltage is desired the control resistance is increased, for instance, to the value R_2. The arc voltage changes to E_{a2}. The shortest arc possible with the apparatus represented by the diagram in Fig. 4 is obtained if the control resistance is short circuited or $R = 0$. The corresponding arc voltage is E_{AO}.

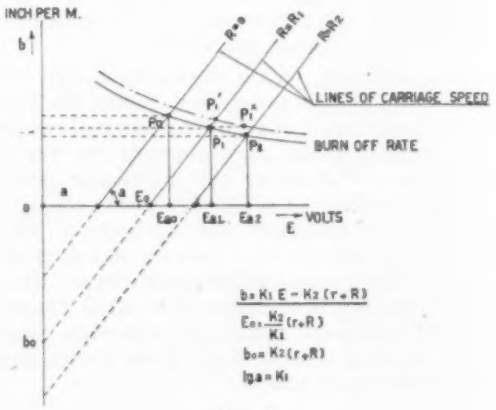

Fig. 4

Some electrodes especially electrodes of class E6020 and E6030 change their characteristic when they become hot, that is, when they are partly consumed. The shifted characteristic is indicated by the dash-dotted line in Fig. 4. The diagram shows that for the hot electrode the point of operation shifts to P'_1 with a slightly increased arc voltage and an increased burn-off rate. The increase of the burn-off rate is not as large as when the arc voltage is controlled for a constant value.

The wiring diagram of the apparatus is shown in Fig. 5. It has not been mentioned yet that some precaution has to be taken when the motor is running on the open-circuit voltage of the welding circuit. To prevent the motor from running away a conventional centrifugal governor (*19*) is employed. This governor is set to open its contacts at a speed slightly higher than the speed used for welding. At this comparatively high speed the contacts of the governor are open and the resistance (*20*) is inserted into the motor circuit preventing the motor from running away. When the arc is struck the voltage impressed on the motor is not high enough to run the governor with open contact and for the duration of the welding operation resistance (*20*) is short circuited.

It is of interest to investigate how the rate of deposit is affected by the angle formed by the electrode and the

line of the bead and by the angle between the line of the bead and the path of the carriage.

These two angles are marked α and β in Fig. 6. We take two arbitrary points A_1 and A_2 on the line of the electrode and project them in the direction of the path of the carriage on the line of the bead, obtaining the points B_1 and B_2. It is obvious that the part of the electrode

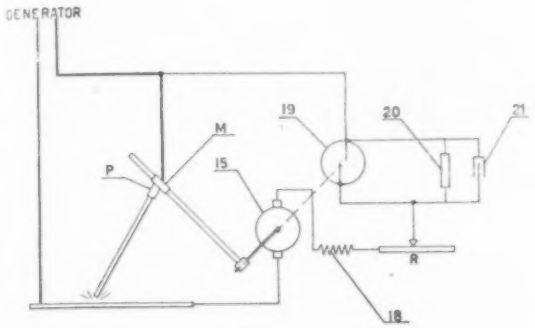

Fig. 5

between A_1 and A_2 will be deposited between B_1 and B_2. Therefore the ratio of $\overline{A_1A_2}$ to $\overline{B_1B_2}$ indicates how long the deposit per inch electrode becomes. It can easily be found that this ratio is

$$\epsilon = \frac{\sin(\alpha + \beta)}{\sin \beta}$$

Generally the angle α of the electrode and the deposit ratio ϵ are decided by the desired welding condition. That determines angle β which can be computed or found graphically.

Operation with Constant Speed

It is possible to reconnect the drive of the apparatus so that the motor runs with permanent constant speed independent of the arc voltage. This connection is shown in Fig. 7. In this case the centrifugal governor (*19*) is used to set the speed of the drive. The motor is supplied from a 110-v. a.-c. line through a fixed resistor (*22*). In Fig. 4 the motor characteristic b = constant is a horizontal line. It is obvious that a shift from the solid to the dash-dotted line would involve a considerable change of arc voltage and therefore arc length. Consequently this kind of operation is usable only for electrodes which do not change their characteristic while they are consumed. In general, electrodes of class E6010 can be used with a constant speed drive.

Possible Applications

The apparatus described here has not been used in the welding industry up to the present time but it is expected that it shortly will be introduced into several possible shop applications. It has been employed in laboratories for the investigation of electrode characteristics. For this particular purpose the elimination of the human element is especially attractive.

Used with constant speed the apparatus exaggerates any change of welding characteristic in the course of consuming an electrode. This is a desirable feature for investigation of electrode coatings.

Used with controlled arc length the apparatus can be used to determine burn-off rates. The fact that the deposit per inch of electrode is constant during the operation makes data obtained this way more dependable.

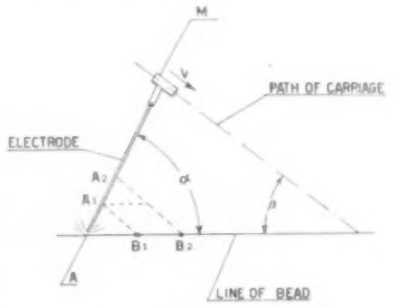

Fig. 6

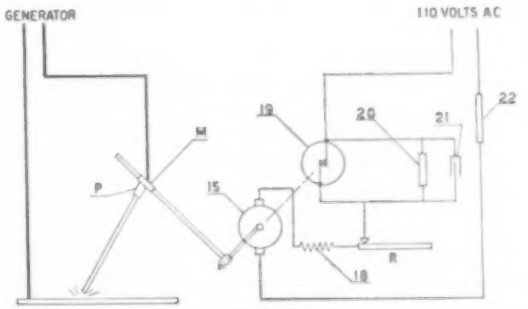

Fig. 7

Appendix

E voltage impressed on motor terminals, v. n speed of motor, r.p.m.

$b = \frac{1}{k_1} n$ speed of carriage, in. per min.

r resistance of motor, ohms

R variable control resistance in series with motor, ohms

T mechanical load of motor, lb.

i = motor current, amp.

$\Phi = k_2 i$ field of motor lines per sq. in.

For a series motor in a d.-c. circuit we may write for the voltage and speed the following relation

$$E = i(r + R) + k_3 n \Phi = i[(r + R) + k_1 k_2 k_3 b] \quad (1)$$

and for the mechanical load

$$T = k_4 \Phi i = k_2 k_4 i^2 \quad (2)$$

this can be solved for i

$$i = \frac{\sqrt{T}}{\sqrt{k_2 k_4}} \quad (3)$$

By substituting (3) into (1) and solving for b we obtain

$$b = \frac{1}{k_1 k_3}\sqrt{\frac{k_4}{k_2}}\frac{1}{\sqrt{T}}E - \frac{1}{k_1 k_2 k_3}(r + R) \quad (4)$$

we substitute

$$K_1 = \frac{1}{k_1 k_3}\sqrt{\frac{k_4}{k_2}}\frac{1}{\sqrt{T}} \quad (5)$$

and

$$K_2 = \frac{1}{k_1 k_2 k_3} \quad (6)$$

It may be noticed that K_1 depends on the mechanical load as may be expected from a series motor. It is

gratifying to see that it depends only on the square root of the load. T can be treated as a constant as the mechanical load of the apparatus does not change during operation.

The point of intersection of the abscissa is

$$b_0 = -K_2 (r + R) \qquad (7)$$

and with the ordinate

$$E_0 = \frac{K_2}{K_1} (r + R) \qquad (8)$$

A change of the control resistance R shifts the line parallel to itself.

Welding in Old Mexico

By F. H. Berry*

THE process of welding can advisedly be referred to as "the world-wide process of welding." Proof that welding is an important factor in "Old Mexico," and that welding is rapidly becoming a factor of major importance in this part of the world is easily discernible for even the casual visitor to this progressive and, in my opinion, future great among the smaller industrial nations.

When I came to Mexico, I expected to find a rather backward and definitely nonindustrial economy. I had heard that the Mexican section of the Pan-American highway was being built, but assumed that project was underway only because other parts of this hemisphere were being joined by a highway, and Mexico happened to lie astride the only available land route. I had heard of the expropriation of Oil Companies which indicated existence of the industry but assumed that this activity could only be a very insignificant one. How very wrong my impressions were, on my arrival here just over two years ago, has been to me a revelation. Probably few of you who read this have other impressions from mine or could possibly know "Old Mexico" as it really is.

A visitor to Mexico in this year of 1946 will see very probably more construction here than anywhere in the world except perhaps in those places where construction is simply the rebuilding of destruction caused by the war. Here in Mexico the new building programs comprise new factories, modernization of old ones, new apartment buildings, new store buildings of the department store type, new warehouse facilities, and the hundreds and hundreds of projects necessary to follow the trend indicated above.

Mexico City has a population today of approximately two and one-quarter million people. Of this total it is safe to say that there has been a gain of approximately three-quarters of a million during the last twelve years.

Where could this great influx of population come from and what are the reasons for the movement? The answer seems to be that Europe and especially Spain supplied a large percentage of this total. In addition, substantial numbers have filtered into Mexico from all other parts of the Western Hemisphere. The balance of the growth came as a result of a tremendous movement from the interior of the Republic of Mexico to the cities. The reasons for these movements are varied. During the early thirties, the large land barons of Mexico, or ranchers, were confronted with loss and break-up of their great holdings in favor of small farms or tracts individually owned. As a result, these former employers left for the cities and were followed by the thousands of former peasants or peon workers who were not successful in acquiring property. Also during this period the Spanish Civil War and general unrest in Europe drove thousands to seek new fields and new homelands.

Many of the members of this new Mexican population were prepared to go into private business. They brought with them helpers, technicians and relatives. The whole group brought new standards and ideas to Mexico.

The diversified industrial development of Mexico includes practically every field of endeavor found in the United States. In many cases, you in the United States, would say that a particular field is practically nonexistent or so small by comparison that no importance could be attached to its progress thus far. However, the roots are here and there is ability, ambition and available capital to assure further development. Education of the general population to want the products of industry is well started, and on its continuance depends the industrial growth of Mexico. Literacy is much higher due to the efforts of the present administration toward education of the general population.

During a six weeks' period of this year covering the months of May and June an industrial exposition was held here in Mexico City. Taking part in the exposition was a cross section of Mexican industry. Three large producers of steel and steel products displayed their wares. The mining industry of Mexico was well represented. The textile industry comprised a large portion of the displayers. The cement producers, the glass products manufacturers, the food canners and processors, and hundreds of small specialty manufacturers all displayed their products to clearly show what the future may bring with the healthy start which has now been achieved.

Permit me, please, to list a few of the outstanding products of Mexican industry. These will all be the prod-

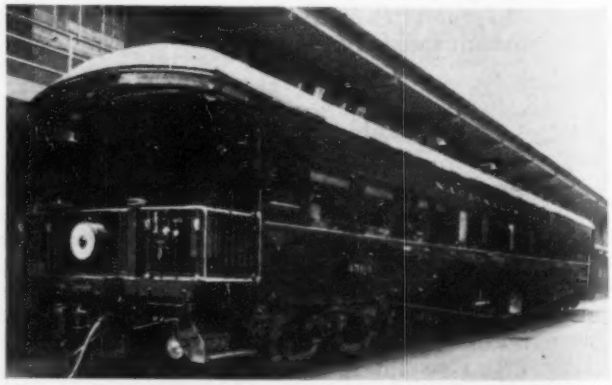

Fig. 1—This Passenger Car Was Given a Roof of All-Welded Construction. The Work Was Highly Satisfactory from the Cost, Time Required and Appearance Factors. Welding Was Performed in the Shops of the National Railways of Mexico

* Manager, Welding Div., La Consolidada, S. A., Mexico, D. F.

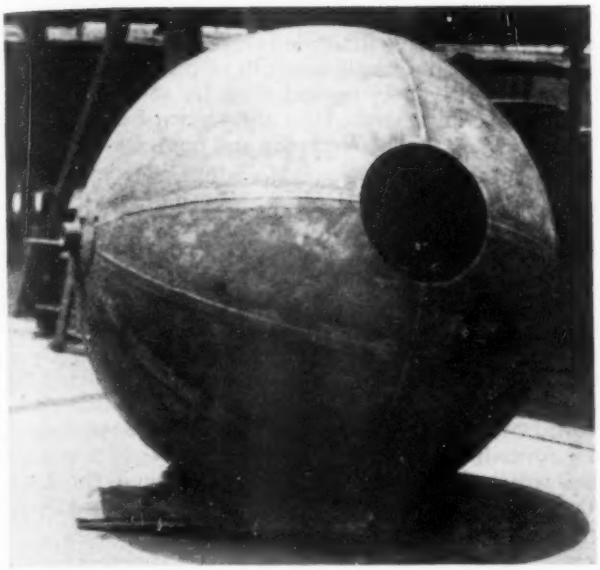

Fig. 2—The Attached Photos Show Welded Steel Tanks Constructed by One of the Largest Fabrication Shops in Mexico. The Fabricator, "Construccion y Montaje, Jeffrey S. A.," Is a Very Progressive Organization Which Specializes in and Promotes Welding Whenever Possible

ucts of greatest present demand and importance. For example, the country has plants now producing all types of steel and iron products such as smaller structural shapes of steel; steel and alloy castings; steel wire for all types of commercial use; railroad rails; thin sheet steel up to $^1/_8$ in. and plate up to $^3/_4$ in. in thickness; pipe, and products such as hand tools; automobile, truck and industrial springs; and bolts, nuts, nails and hardware of many types.

There are plants producing copper wire and cable for every type of application, using ingot copper and rolling, drawing and covering with every type of material including plastics. There are mines producing silver, gold, lead, zinc, copper and small amounts of other metals such as antimony and tin. Coal is produced and coke is manufactured. Farm machinery is now manufactured here. Silver is processed into all the beautiful articles for home use and personal adornment. Leather goods of all kinds including alligator skin products are of importance. Food growing and processing including the cultivation of banana plantations, pineapple groves and orange groves takes a prominent place in Mexican industry.

What of the future for a country with such natural resources and such a potential market? It must be inestimable. Many millions of dollars are now being invested to provide better facilities. New steel furnaces, new rolling mills, new farm machinery plants, new food processing plants, new plants to manufacture electrical equipment for the home and new plastic plants are now being built. Then, too, transportation is being rapidly improved. New equipment for the railroads has been delivered and more will steadily arrive. Roads are becoming important arteries for traffic. Rural electrification programs of enormous magnitude are well under way.

It is unnecessary for me to state how welding will apply in all this general development. It is only necessary for you, the readers, to know that modern methods of presenting welding and education for use of welding are being used. One supplier has increased his sales tremendously in a two-year period by providing trained technicians and sales engineers to show the clients how to do more and better welding and to help sell the buying public on welding as a process. Certain electrodes primarily of the E-6010 and E-6012 types and filler metal for oxyacetylene welding and hard surfacing are manufactured, following standards of the AMERICAN WELDING SOCIETY. There are several producers of oxygen and acetylene gas.

Deliveries of welding machines of all types during the year of 1945 by one supplier were approximately double the best previous year's sales. Deliveries of E-6010 and E-6012 types electrode were approximately triple best previous sales. Deliveries of alloy electrodes including those for use in welding cast iron, aluminum, stainless steel and for hard facing increased over 400%. The use of uncoated commercial wire as a filler metal for welding,

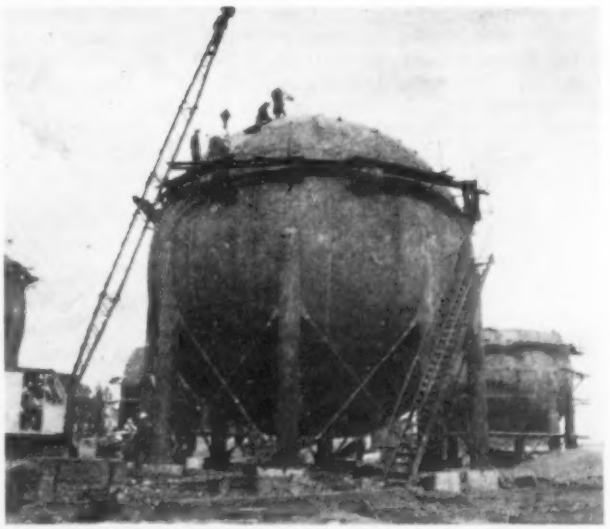

Fig. 3—All-Welded Construction of Tanks for the New High-Octance Refinery in Mexico City. Contractor Was Arthur G. McKee Co. of Cleveland, Ohio. The Subcontractor Was Chicago Bridge and Iron Co. for the Special Tank Construction. All Work Was Performed for Petroleos Mexicanos Which Is the Mexican Government Dependency Operating Oil Facilities in Mexico

together with use of wire similar to that used in manufacture of E-6012 but having a light coating of magnetite, calcium carbonate, and prepared sodium silicate in formula, dropped from approximately 55% of total sales of mild steel electrode to approximately 15% at the present time and was replaced by use of extruded electrode. All of the sales of equipment, electrodes and supplies were distributed among fabricators, including divisions of the railroads, the oil industry and hundreds of shops constructing replacement parts for mines, cement plants and others too numerous to mention.

The included photos give you a small idea of the types of work done now using welding as the major construction tool. They show construction at the new high octane gas refinery built for the Government-controlled oil industry by prime contractor Arthur G. McKee & Co. and subcontractor Chicago Bridge and Iron Co. Others show some general welded products of one of the largest fabrication shops. Still another shows a little of what the National Railways does in the way of welded construction.

The progress of welding here in Mexico, and the open-minded, progressive attitude is clearly shown by the demand for welding machines both of the motor generator and engine-driven type, and even by some demand for automatic equipment. It is also shown by the demand for every type of alloy electrode and nonferrous electrode.

It is, of course, necessary to admit that Mexican industry is far behind the United States industry in welding application. Perhaps 25% of the welding which could be done at the present industrial level is being done, and the potential is enormous when evaluated in the light of potential industrial progress. We estimate that in comparison with electrode consumption to steel consumption, United States industry makes use of electrode in a ratio of three to one to Mexico. However, in many cases the United States industrialists must admit that the opposition to change, and to application of new ideas and new procedures is stronger among them than it is among their worthy neighbors to the South. You in the United States had better progress rapidly for Mexico is progressing rapidly.

Welded Construction Provides Economical and Rigid Shop Structure

By A. F. Davis*

A PRE-FABRICATED shop building of standard universal design, available in various sizes and for various uses, that is sold all over the world by the Butler Manufacturing Co., of Kansas City, Mo., offers an outstanding example of how structural electric arc welding can be applied to obtain rigid construction and clean interior.

The building, shown under construction, in the accompanying illustration, is for occupancy when completed by a steel fabricating company. Less steel is used in welded rigid connections than in conventional truss and column construction, Butler Manufacturing reports, which provides the most economical structure for this type of shop building.

All of the primary members were made up of plate steel (see Fig. 1). Substitutions in the thicknesses of the plate steel could be freely made because of the arc-welded construction. The complete bracing system is made up of structural angles (Fig. 1), and the strut members are built up from angle irons and rods before welding.

The struts, columns, haunches, roof beams and purlins were shop fabricated, which left the final assembly of rigid frames and craneway for fabrication at the building sites. The columns and haunches were tapered to reduce the structural tonnage required to carry the design load (Fig. 1).

Production at the Butler Manufacturing Co., in Galesburg, Ill., is stepped up by automatically welding all columns.

The welded connections at the eaves and at the third points of the roof are field welded. Bolted joints, noticed at the top of the pre-fabricated structure (Fig. 1), are used only during primary erections. Later, when the building is being permanently erected, the joints at the top and on all the sides are arc welded to assure permanent rigidity and strength.

Joints were tack welded before finish welding was accomplished, and all work was first fitted to templates before the finish welding was done.

The finished structure has a floor space area of 31,200 sq. ft., being 400 x 78, with a roof height of 40 ft. 6-in., and is comprised of 20 ridge struts, 40 girt struts, 40 eave struts and 21 rigid frames. The structure, when completed, is covered with corrugated galvanized sheets.

* Vice-President, The Lincoln Electric Co. Cleveland 1, Ohio.

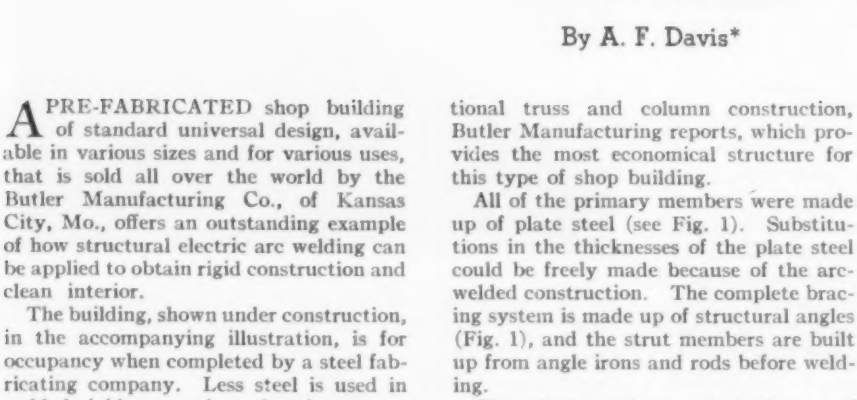

Fig. 1

This prefabricated shop building offers an outstanding example how structural electric arc welding can be applied to obtain rigid construction and clean interior. Bolted joints at the top and sides of the structure are later welded to assure rigidity and strength when the building is being permanently erected.

Radiography of Spot Welds in Various Sheet Gages and Dissimilar Gage Combinations

By R. C. McMaster,* F. C. Lindvall† and L. P. Gaard‡

Introduction

PRECEDING papers of this series have presented discussions of the interpretation of radiographs of spot welds in equal thickness two-layer combinations of light alloy and ferrous sheet materials.[1,2] Examples shown in those papers were limited, for the most part, to welds in 0.040–0.040-in. sheet thickness combinations. The corresponding reproductions of radiographs and weld sections could then be subjected to direct comparison without errors in interpretation caused by size effects. However, many industrial spot welds are made in sheets of other thicknesses, and in combinations of dissimilar sheet thicknesses. The influence of sheet thickness and of gage combination upon the interpretation of spot weld radiographs is discussed further in this paper.

Extensive tests of spot weld radiography were made for spots welded with energies varying from the minimum to the maximum feasible, in two-layer equal-thickness combinations of 24ST Alclad aluminum alloy in all commercial gages from 0.020 to 0.156 in. In addition, similar tests were made for welds in dissimilar thickness combinations of 0.040-in. 24ST Alclad aluminum alloy sheets with each available gage from 0.040 to 0.188 in. Spot-weld radiography was found to be a useful inspection method throughout the range of sheet thicknesses investigated. It was found that all features of the radiographic images could be interpreted correctly by a logical extension of the methods of interpreting radiographs of spot welds in 0.040–0.040-in. sheets. However, new features were observed which are now discussed in further detail.

The Influence of Sheet Thicknesses Upon Exposure Technique and Upon Requirements for X-Ray Equipment Capacity

Several X-ray sources in different locations were used in the radiography of the nearly 2000 spot welds inspected in these tests. The sources were of various types and capacities, with widely different inherent filtration characteristics. They were used at different source-object distances, and with various independently determined exposure techniques. The actual exposure conditions are listed in Table 1. These data were reduced, by means of the inverse square law, to values for a fixed source-object-distance of 1 in., and plotted in Fig. 1. Most of the data then fell into reasonable scatter bands. These indicated that the operators chose to increase the kvp. in almost linear proportion with the total sheet thicknesses, from about 20 kvp. at 0.040 in. total thickness to about 40 kvp. at 0.250 in. total thickness. At the same time, the milliampere-second exposures were decreased almost in proportion to the reciprocal of the sheet thickness, from about 80 milliampere-seconds at 0.040 in. total thickness to about 30 milliampere-seconds at 0.250 in. thickness. The resultant radiographs were

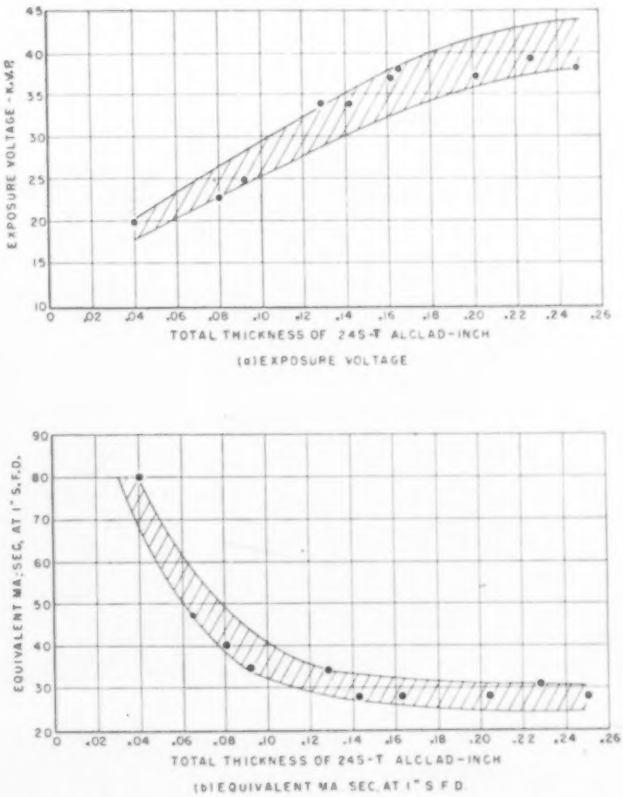
EXPOSURE VOLTAGE - KVP
TOTAL THICKNESS OF 24S-T ALCLAD-INCH
(a) EXPOSURE VOLTAGE
EQUIVALENT MA.-SEC. AT 1" S.F.D.
TOTAL THICKNESS OF 24S-T ALCLAD-INCH
(b) EQUIVALENT MA. SEC. AT 1" S.F.D.

Fig. 1—Typical Exposure Conditions for 24ST Alclad Aluminum Alloy Spot Welds, Reduced to 1-In. Source—Object Distance

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‡ Formerly Assistant to Project Engineer of Aircraft Welding and X-Ray Research Projects at the California Institute of Technology, now Research Technician at G. M. Giannini Co., Inc., in Pasadena, Calif.

Table 1—Exposure Conditions for Spot-Weld Radiographs

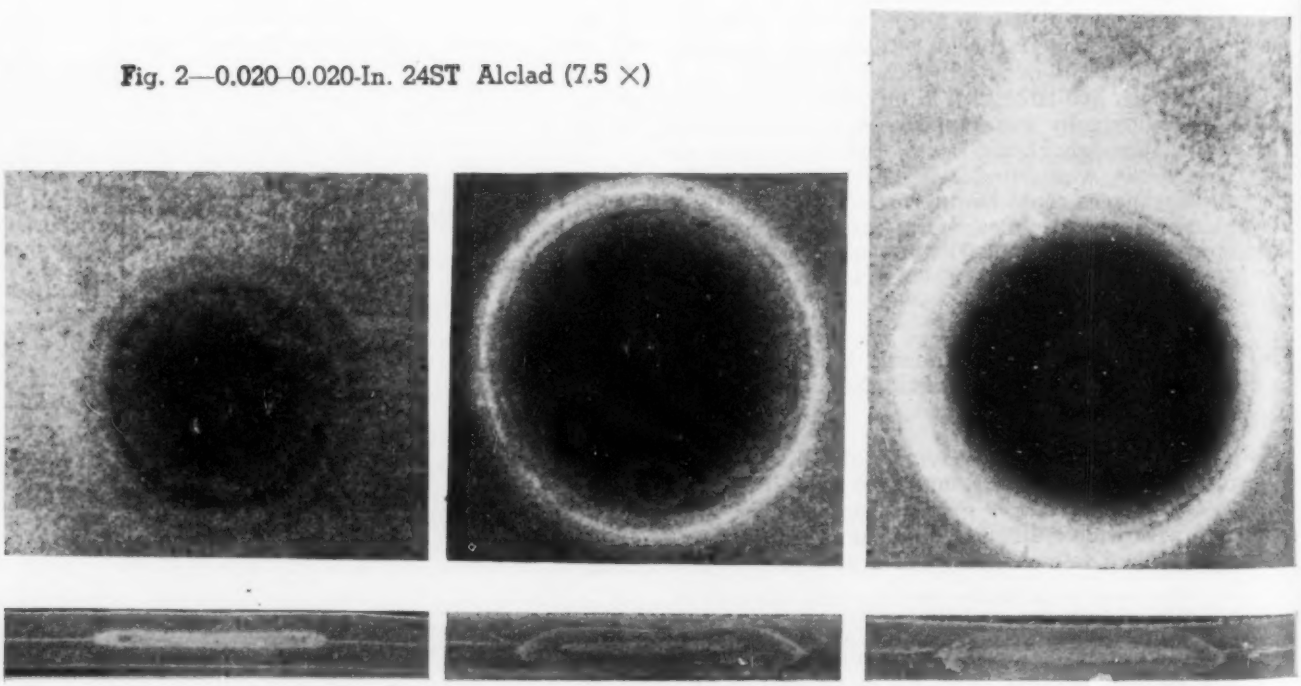
Gauge Combination, Inches	Total Sheet Thickness, Inches	X-Ray Source No.	Actual S.F.D., Inches	K.V.P.	Ma.	Exposure Time, Seconds	Actual Ma.-Sec.	Equivalent Ma.-Sec. at 1" S.F.D., Ma.-Sec.
.020 - .020	0.040	1	1-1/8	20	30	3	90	80
.040 - .040	0.080	3	2	23	4	40	160	40
.040 - .051	0.091	3	2	25	4	35	140	35
.040 - .064	0.104	2	2.5	-(a)	14	20	280	70
.040 - .081	0.121	2	2.5	-(a)	14	20	280	70
.064 - .064	0.128	4	4	34	10	55	550	34.3
.040 - .102	0.142	4	4	34	10	45	450	28
.081 - .081	0.162	4	4	37	10	45	450	28
.040 - .125	0.165	4	4	38	10	45	450	28
.102 - .102	0.204	4	4	37	10	45	450	28
.040 - .188	0.228	4	4	38	10	50	500	31
.125 - .125	0.250	4	4	39	10	45	450	28

(a) 30 primary volts

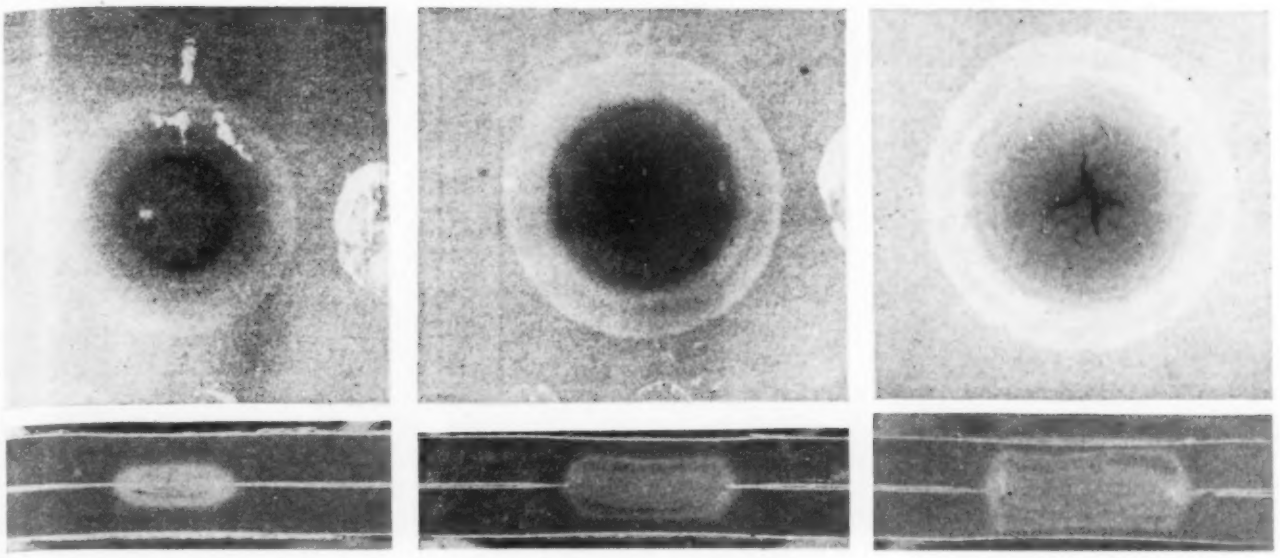
Description of X-Ray Sources:

1. Picker 50 K.V.P. industrial X-ray unit with water-cooled tungsten target, beryllium window, self-rectified, 30 Ma. continuous current rating.
2. General Electric X.R.D. diffraction X-ray unit (Triplett and Barton, Inc.), with water-cooled tungsten target, beryllium window, self-rectified.
3. Laboratory 25 K.V.P. Grentz ray unit with air-cooled tungsten target, Lindemann bubble glass window, self-rectified, 5 Ma. continuous current rating.
4. X-Ray Products Corporation 85 K.V.P. fluoroscopic unit with air-cooled tungsten target, 10 Ma. continuous current rating.

Fig. 2—0.020–0.020-In. 24ST Alclad (7.5 ×)



2100 V., 480 Mfd. 2500 V., 480 Mfd. 2800 V., 480 Mfd.

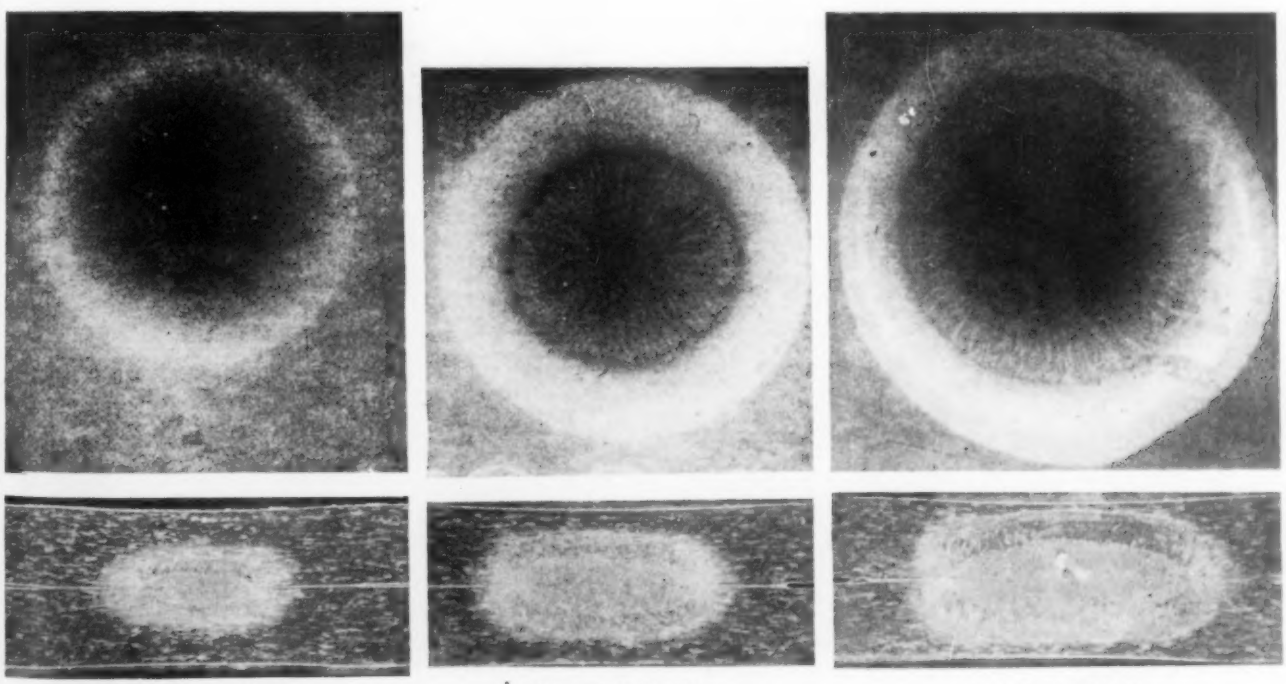


2000 V., 1200 Mfd. 2500 V., 1200 Mfd. 3000 V., 1200 Mfd.

Fig. 3—0.064–0.064-In. 24ST Alclad (4 ×)

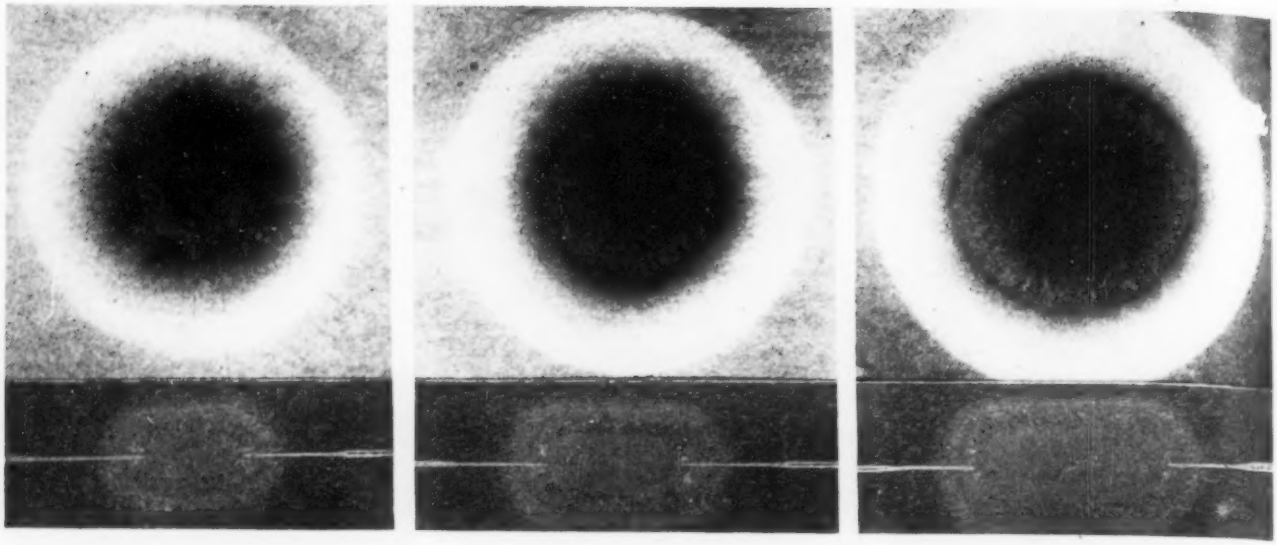
all of acceptable density, between 2.5 and 2.8, so that the full contrast range of Eastman Type M film could be exploited.

The radiographs showed improving contrast sensitivity and definition as sheet thickness was increased, under these exposure conditions. Furthermore, the actual exposure times, assuming a 30-milliampere X-ray source operating at about 1-in. source-object distance, decreased from 2.7 seconds for the 0.040 in. total thickness to about one second for the 0.250 in. thickness. From these tests it is readily apparent that a 50 kvp. X-ray source will be adequate for all gages of light alloys commonly spot welded, and (with low inherent filtration) the normal operating range will lie between 15 and 45 kvp. Increasing sheet thicknesses tends to make spot-weld radiography easier, providing clearer radiographs with shorter exposure time than can be utilized with thin sheets. The larger weld images are more easily examined and interpreted. It is interesting to note that the exposure conditions are determined solely by the total thickness of all of the sheets in the weld region, whether this total thickness be produced by two equal thickness layers, by dissimilar gage combinations or by multiple layers.



2100 V., 3000 Mfd. 2400 V., 3720 Mfd. 2700 V., 4800 Mfd.

Fig. 4—0.102–0.102-In. 24ST Alclad (4 ×)



2200 V., 4440 Mfd. 2500 V., 4440 Mfd. 2600 V., 5520 Mfd.

Fig. 5—0.125–0.125-In. 24ST Alclad (4 ×)

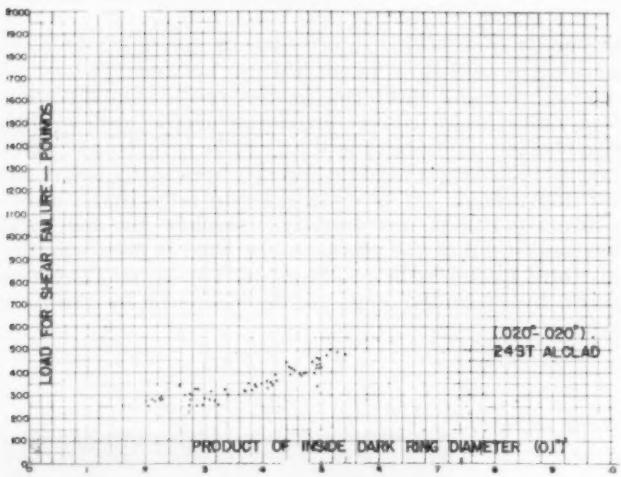


Fig. 6—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.020–0.020-In. 24ST Alclad Aluminum Alloy Sheets

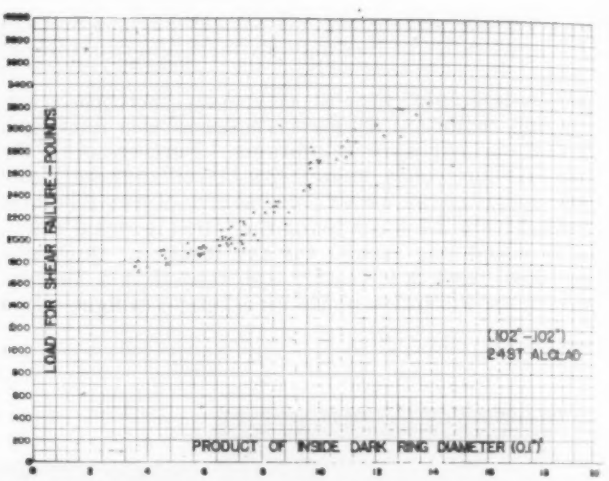


Fig. 8—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.102–0.102-In. 24ST Alclad Aluminum Alloy Sheets

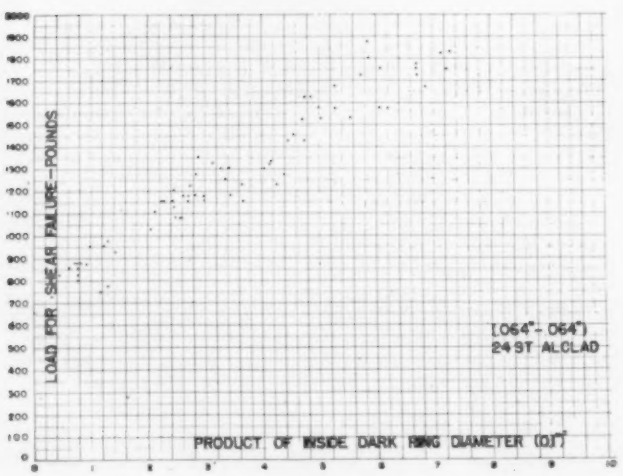


Fig. 7—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.064–0.064-In. 24ST Alclad Aluminum Alloy Sheets

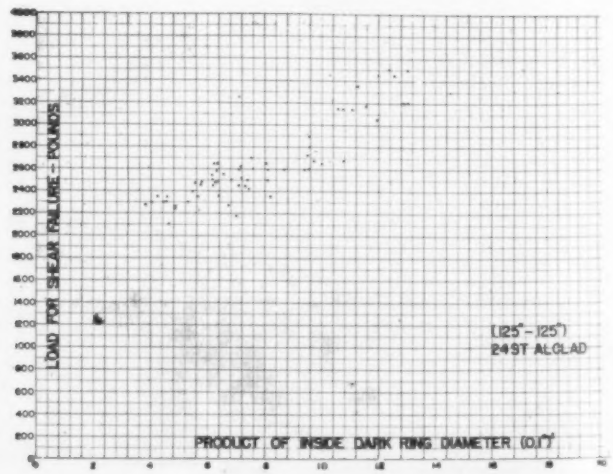
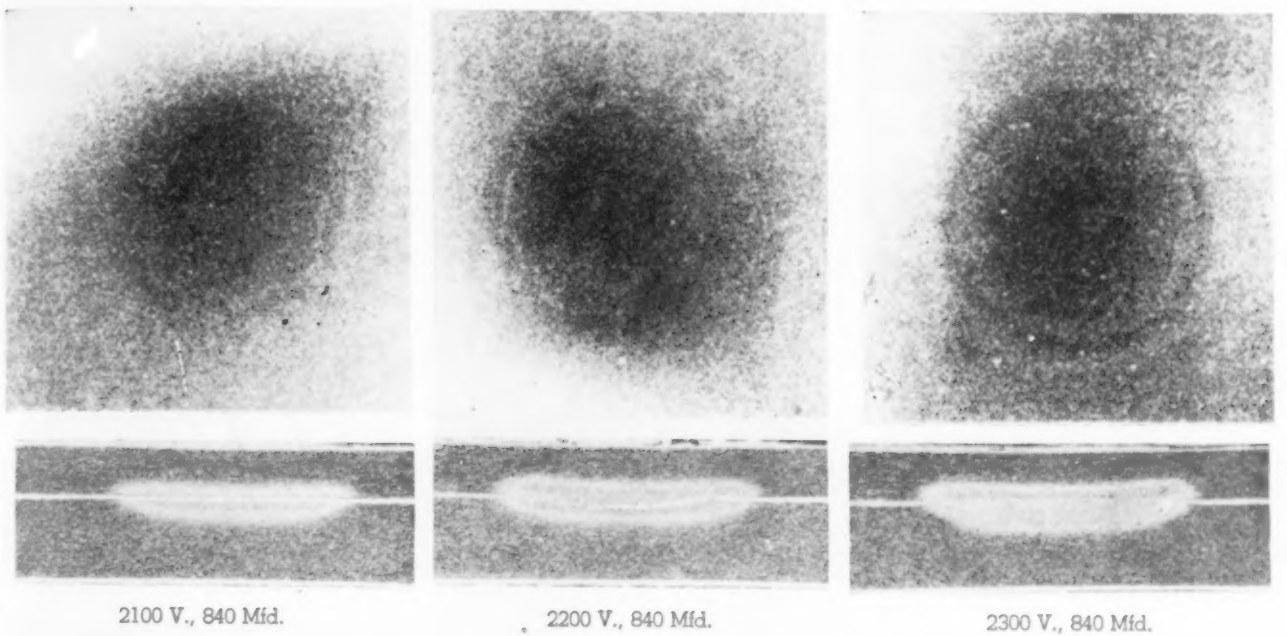


Fig. 9—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.125–0.125-In. 24ST Alclad Aluminum Alloy Sheets

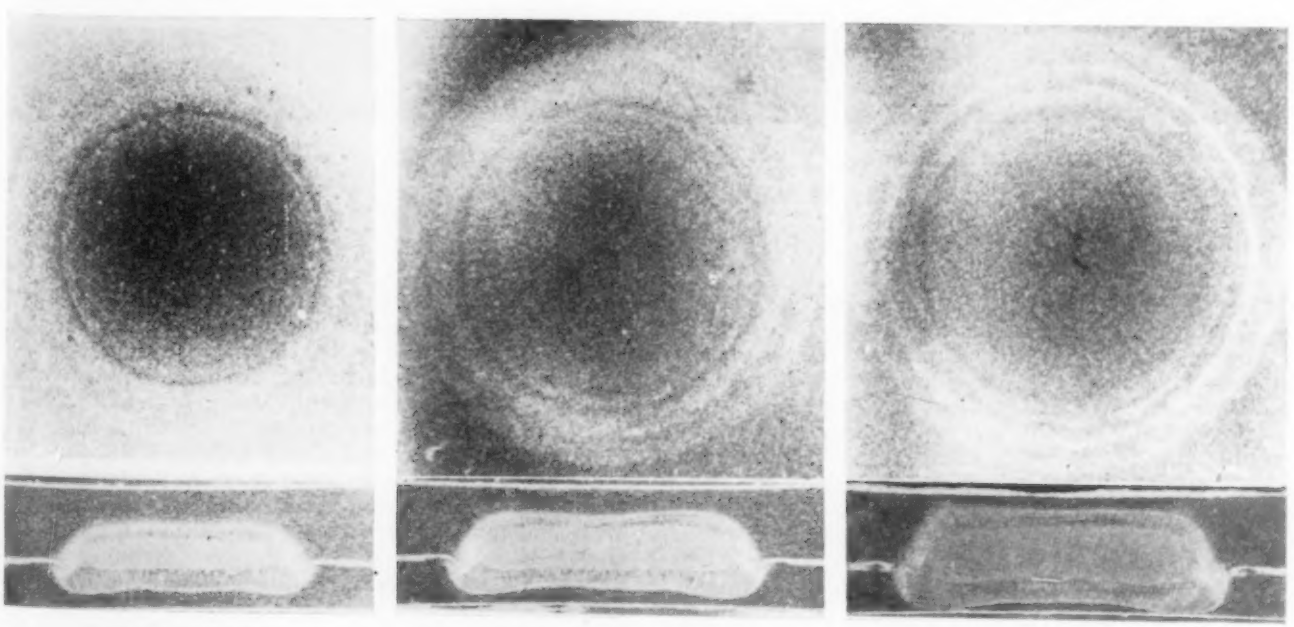
Two-Layer Equal-Sheet-Thickness Combinations

Corresponding radiographs and weld sections for typical sheet thicknesses varying from 0.020 to 0.125 in. are shown in Figs 2 through 5. The radiographs show similar features, which appear larger and more clear for the welds in the thicker sheets. As with the 0.040-in. sheet material discussed in detail in a preceding paper,[1] the radiographs show positive indications of absence of the weld nugget, undersize weld nuggets, excessive Alclad inclusion at the faying plane, cracking in the weld nugget, porosity in the weld nugget, segregation of eutectic in the parent material, expulsion or extrusion of the nugget at the faying plane, oversize or misshapen weld nuggets and tip pickup. All of the methods of interpretation presented in the preceding paper apply for all thicknesses of 24ST Alclad and 75ST Alclad sheet materials. Similarly the weld defect classification chart presented in another paper[3] is applicable throughout the entire range of gages, with the understanding that all details of the radiographic images increase in size in proportion with the sheet thickness.

The static shear strength of the welds can be predicted reliably from the radiographs, throughout the entire range of sheet thicknesses, for 24S, 75S and similar alloys containing significant percentages of radiographically dense alloying constituents. In any single sheet gage, the weld strength correlates well with the net area of cast-alloy nugget bonding at the faying plane, which is indicated by the area within the prominent dark ring on the radiographs. However, the same absolute diameter of weld nugget represents increasingly stronger spot welds as sheet thickness increases. The thick sheets apparently provide reinforcement and stiffening in the

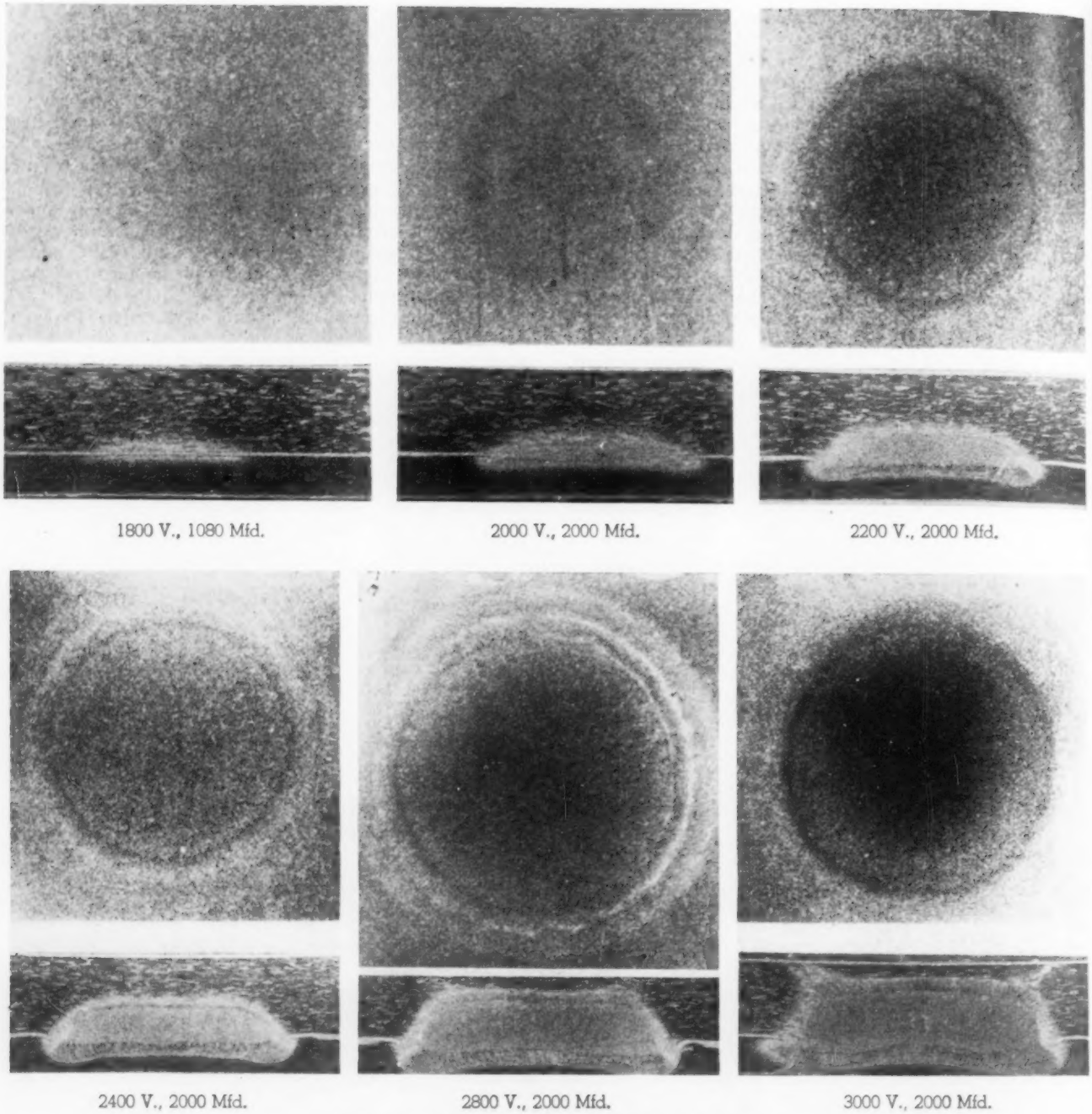


2100 V., 840 Mfd. 2200 V., 840 Mfd. 2300 V., 840 Mfd.



2600 V., 840 Mfd. 2800 V., 840 Mfd. 3000 V., 840 Mfd.

Fig. 10—0.040–0.064-In. 24ST Alclad (7 ×)



1800 V., 1080 Mfd. 2000 V., 2000 Mfd. 2200 V., 2000 Mfd.

2400 V., 2000 Mfd. 2800 V., 2000 Mfd. 3000 V., 2000 Mfd.

Fig. 11—0.040–0.081-In. 24ST Alclad (6 ×)

static shear test coupons. The curves of Figs. 6 through 9 show typical correlations between shear strength and the area within the radiographic dark ring, throughout the range of sheet gages investigated. Because of poor welding technique and inadequate electrode tip forces during welding and forging, and correspondingly inadequate tip radii, the welds in the thicker sheets did not reach normal diameters. The correlations are not so good as would be obtained with properly made industrial spot welds (see references 4 and 5 for examples of welds in thicker sheets, made with optimum welding conditions).

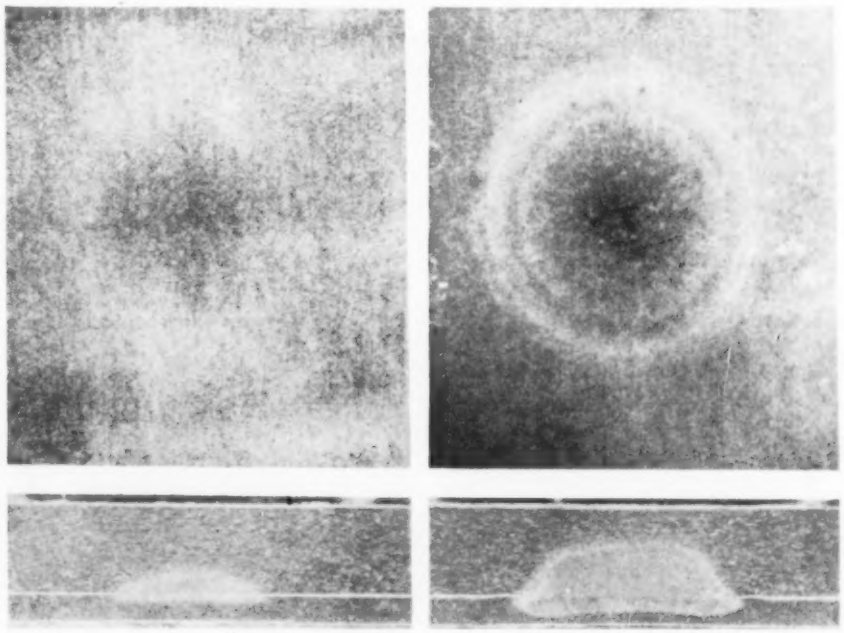
Two-Layer Unequal-Sheet-Thickness Combinations

The corresponding radiographs and weld sections shown in Figs. 10 through 13 for combinations of 0.040-in. sheet with dissimilar thickness sheets varying from 0.064 to 0.188 in. reveal many interesting features. From a comparison of these radiographs with the preceding group, it is clearly evident that the methods of interpretation developed for equal thickness combinations may be modified to apply to spot welds in dissimilar thickness combinations of 24S and similar aluminum alloys. The same prominent features occur in the radiographs of the dissimilar thickness combinations, for the same causes as with similar thickness layers. In addition, the complex shapes of the weld nuggets in the very dissimilar thickness combinations produce additional details in the radiographs.

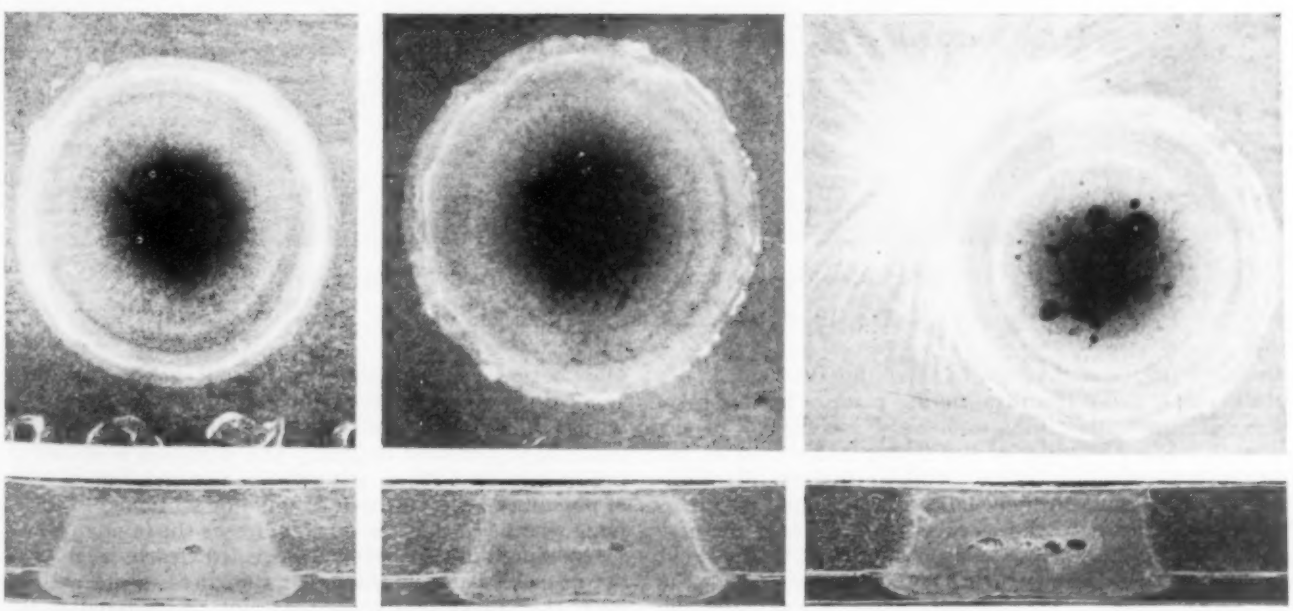
The prominent dark ring appears throughout the range of thickness combinations, when weld nuggets are present at the faying plane. In most cases, the outer boundary

of the dark ring continues to outline the outer boundary between the weld nugget and the parent material. It should be noted that in these welds the largest diameter of the weld nugget occurs in the thinner sheet. The inner extremity of the dark ring reveals clearly the inner extremity of the Alclad inclusion at the faying plane, and thus measures the area of bonded cast nugget alloy. Welds with 100% Alclad inclusion or with no nugget lack the dark ring and other radiographic features of acceptable welds. Even islands of Alclad material carried into the nugget but not alloyed into the nugget are clearly revealed, as are doughnut and crescent welds when they occur.

With the more unequal thickness combinations, additional dark rings may appear on the radiograph, each corresponding to a circumference of the nugget wall. These rings become quite prominent in the case of large nuggets with nearly vertical walls in the thicker sheet, as shown by the high-energy welds in the 0.040–0.125-in. sheet thickness combination. With welds made under reasonably normal conditions, the nugget has its largest diameter in the thinner sheet, so that the outermost dark ring will have as its inner boundary the inner extremity of the Alclad inclusion at the faying plane. In this case, the dark ring is a reliable measure of the weld shear strength. However, it is quite possible (although no such examples were found in more than 1000 dissimilar thickness combination spot welds examined during this research) that with extreme contact heating at the tip of the welding electrode in contact with the thicker sheet,

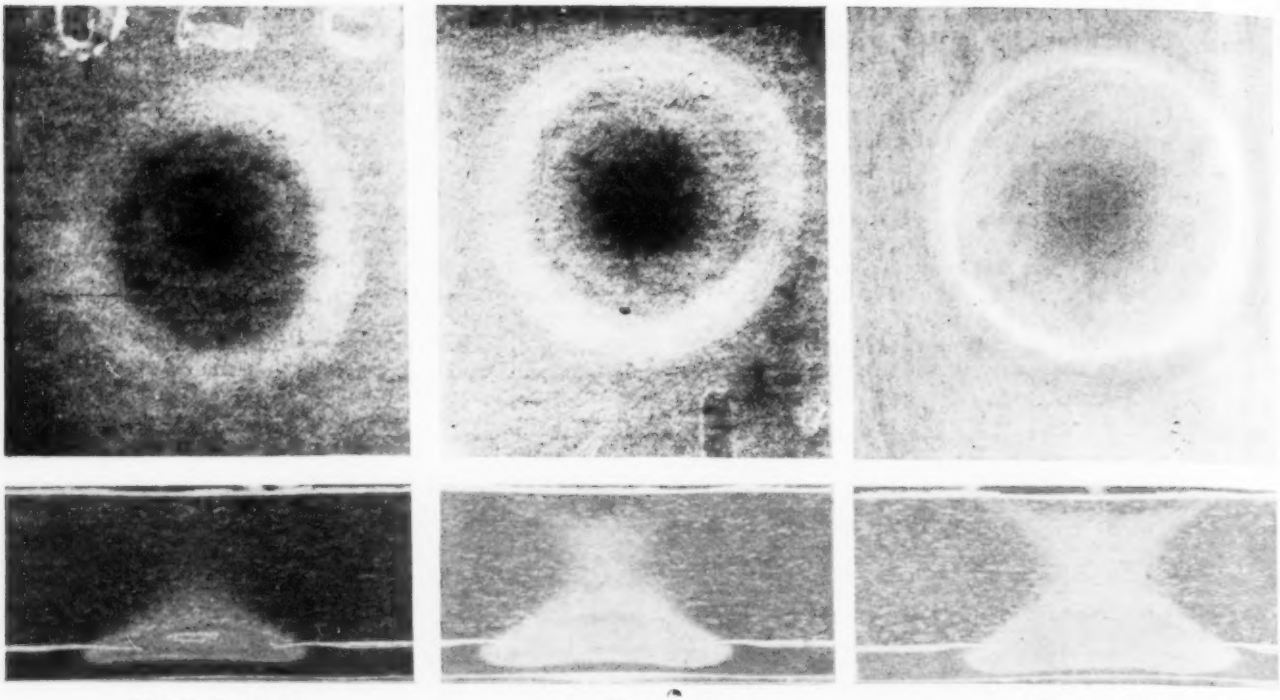


2000 V., 2400 Mfd. 2400 V., 2400 Mfd.

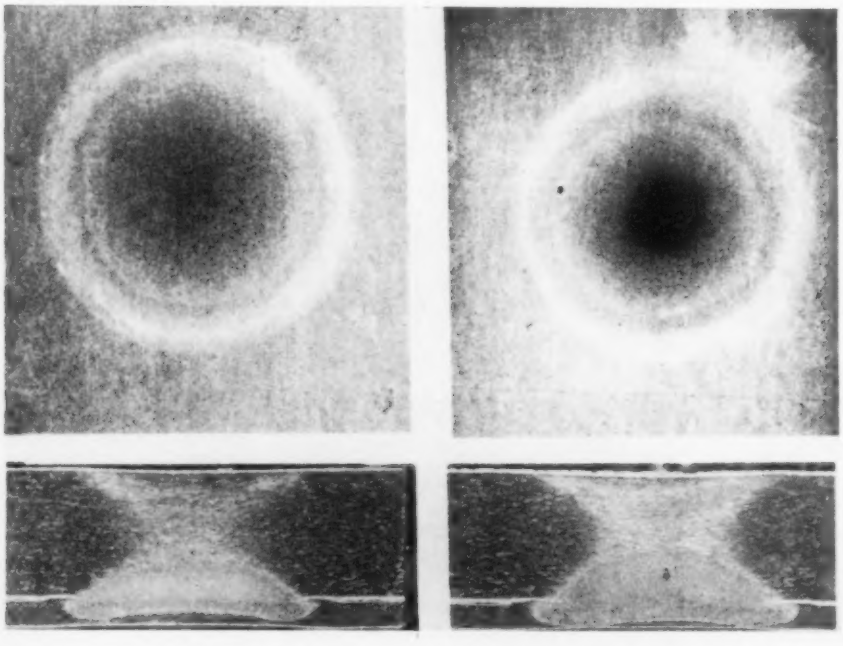


2800 V., 2400 Mfd. 2900 V., 2640 Mfd. 3000 V., 2640 Mfd.

Fig. 12—0.040–0.125-In. 24ST Alclad (Above 6 ×; Below 4 ×)



2200 V., 2640 Mfd. 2300 V., 2640 Mfd. 2500 V., 2640 Mfd.



2800 V., 2640 Mfd. 3000 V., 2640 Mfd.

Fig. 13—0.040–0.188-In. 24ST Alclad (4 ×)

the weld nugget might grow to maximum diameter in the thick sheet, away from the faying plane. In this case, the outermost dark ring would not correspond to the area of nugget bonding at the faying plane. In an extreme case (which is very difficult to produce intentionally) the weld nugget might be confined entirely to one of the two dissimilar thickness sheets, not crossing the faying plane, and therefore not contributing to the weld strength. Such weld nuggets produce dark rings (for the same reasons as do normal weld nuggets) outlining the boundary between the weld nugget and the parent material. Such nuggets have been produced by passing welding current through a single thickness of aluminum alloy between the electrodes of the spot-welding machine. Dark rings produced in this manner have no correlation with weld strength, but still indicate reliably the contour and size of the weld nugget. The situation is so rare in production that it can generally be ignored, but in cases of possible doubt, test welds should be sectioned to determine whether or not the nugget crosses the faying plane.

Cracking and porosity are revealed clearly when present in welds between dissimilar thickness sheets. However, the cracks and voids may not be centered at the faying plane. In combinations of a thin sheet with a very thick sheet, the voids are often located near the center of the weld nugget, which may be displaced from the fay-

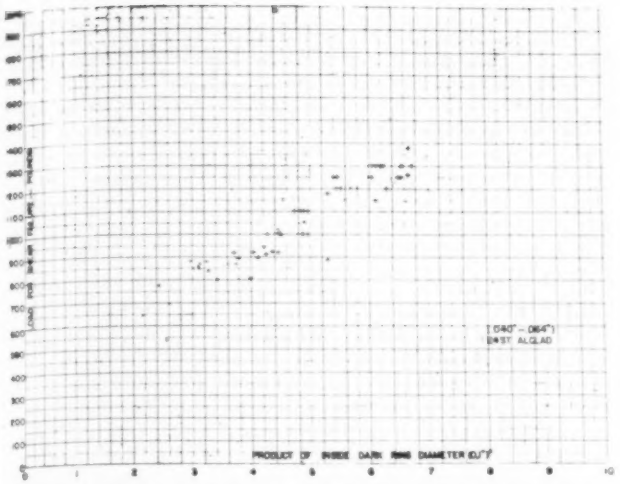


Fig. 14—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.040–0.064-In. 24ST Alclad Aluminum Alloy Sheets

ing plane far into the thicker sheet. In this case, it is quite open to doubt whether the voids influence the weld strength in any way, although they do indicate undesirable process control or welding conditions.

Extrusion and expulsion at the faying plane are common defects in welds between sheets of unequal thickness, and are clearly shown on the spot-weld radiographs. These defects should be interpreted and evaluated just as in the case of equal thickness sheets. Since extrusion causes excessive sheet separation, it may be particularly undesirable when a thin and a thick sheet are joined by spot welding.

The corona ring and the white ring revealing segregation of eutectic in the parent material appear throughout the series of thickness combinations. Since extensive segregation of eutectic is a sensitive indicator of excessive welding heat, it is an especially useful guide in dissimilar sheet thickness combinations. When widely different thicknesses are joined by a spot weld, the nugget diameter increases with welding heat up to a certain point, beyond which most of any further increases in welding heat serve only to increase the nugget penetration, which may become excessive, particularly in the thinner sheet. Excessive penetration will often be accompanied by evidences of tip pickup which appear clearly, when pickup occurs, on the radiograph.

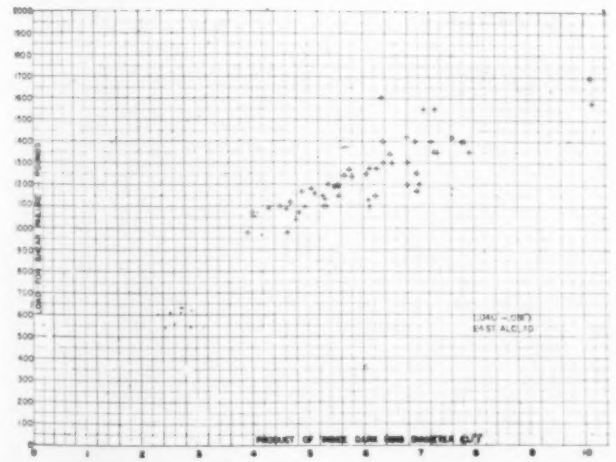


Fig. 15—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.040–0.081-In. 24ST Alclad Aluminum Alloy Sheets

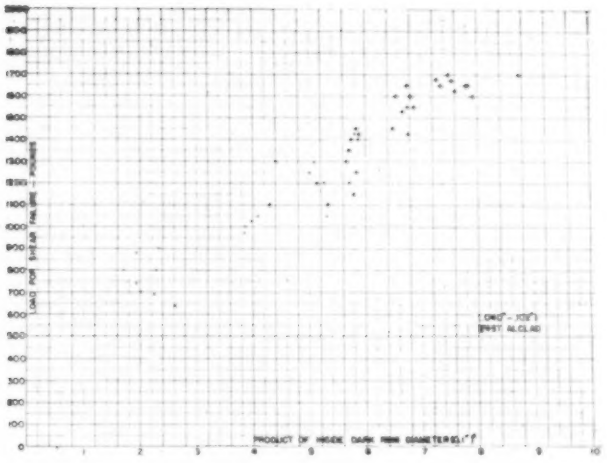


Fig. 16—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.040–0.102-In. 24ST Alclad Aluminum Alloy Sheets

When very thick sheets are joined to thin sheets, spot welds of normal energy may be accompanied by extensive regions of incipient melting, particularly along grain boundaries, in the parent material of the thicker sheet between the weld nugget and the welder electrode contact point. These appear prominently in the radiographs of welds in 0.040–0.188-in. thickness sheets, shown in Fig. 13. Apparently radiographically dense constituents migrate from these regions of incipient melting, just as they do from the region of the nugget boundary. These conditions produce a relatively transparent zone through the heart of the weld region, and probably weaken the parent material, although no tests to date have indicated that the welds are weakened by this condition.

The correlation between weld static shear strength and the area within the radiographic dark ring which outlines the nugget at the faying plane is as valid for dissimilar thickness combinations as for spot welds between equal thickness sheets. Figures 14 through 17 show values obtained from welds tested during this research. Most of the welds were made under very poor welding conditions, and better correlations have been obtained on normal industrial spot welds in the same gage combinations. Since these were laboratory welds in sheets prepared by wire brushing, extensive corona bonding

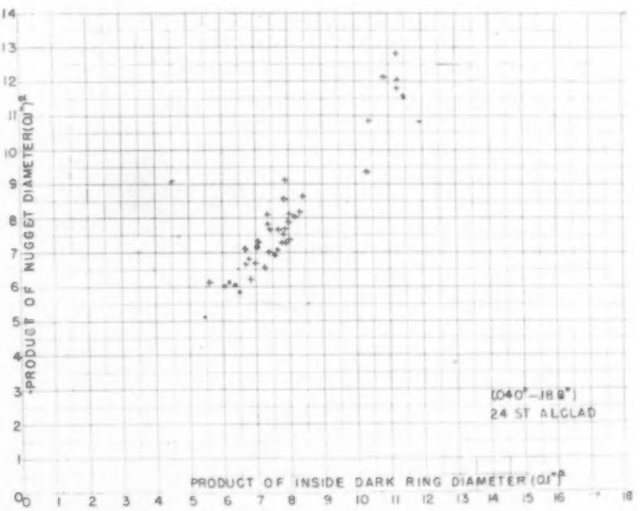


Fig. 17—Correlation Between Load for Shear Failure and Area Within Inner Boundary of the Radiographic Dark Ring A-A. 0.040–0.188-In. 24ST Alclad Aluminum Alloy Sheets

occurred, contributing a significant portion of the total static shear strength of the weld. This contribution was not measured by the radiographic measurement of the nugget diameter at the faying plane. As a result, in these and in all wire-brushed laboratory specimens, the spread of points on the graphs is greater than with chemically prepared industrial specimens.

These results were confirmed by subsequent extensive tests of spot-weld radiography in aircraft factories, in which spot welds were radiographed in a wide variety of dissimilar gage combinations used in production. No difficulty was encountered in interpreting the weld properties from radiographs even in the most dissimilar thickness combinations found in factory tests. It may therefore be assumed that the interpretation of weld quality from radiographs presents no difficulties, for thickness ratios up to at least 3:1.

Three or More Layer Sheet Combinations

The investigation of spot welds in multilayer sheet combinations was specifically omitted from this research program, in order that the basic problems of two-layer spot welds might be more fully investigated. Nevertheless, the possibility of radiographic inspection of spot welds in multilayer sheet combinations remains an important problem worthy of immediate research. Many multilayer sheet combinations are spot welded in industry; in one factory it was found that two-layer sheet combinations were actually in a minority in the production spot-welding department.

In factory tests of radiographic techniques developed during this research, however, many multilayer sheet combinations, frequently of dissimilar gages, were encountered. It was found that they could be radiographed readily, using techniques appropriate for the total thickness of the combination. All normal weld properties were shown for sheet alloys such as 24S and 75S. Radiography was found to be an excellent guide in process control. One serious drawback was met in these tests, namely, one or more dark rings appeared on the radiographs. These dark rings corresponded, as might be expected, to the net area of cast-alloy nugget bonding at each faying plane, which was desirable. However, in some cases, the total number of dark rings was not so large as the number of faying planes. This situation resulted in most cases because the nuggets were symmetrical at two or more faying planes, and the radiographic images of the nugget boundaries at the different faying planes coincided. In other cases, the nugget failed to cross one or more of the faying planes, so that the weld had no strength at these faying planes. Yet this situation could not be detected reliably from the radiographs, which might have quite normal dark rings from the faying planes through which the nuggets did pass. For this reason, on the basis of these tests alone, it cannot be guaranteed that ordinary spot-weld radiography will reveal the weld strength at each faying plane in a multilayer spot weld.

Further research on this matter is certainly desirable, and the problem can probably be solved readily. One technique worth serious trial is that in which the X-ray beam is allowed to impinge upon the spot-welded sheets, not normally as is usually the case, but at an angle, say 30°, from the perpendicular. In this case, the radiographic images of the various faying planes in the multi-layer spot weld would be displaced from each other on the X-ray film, so that each should be revealed distinctly. If this technique failed to reveal clearly which nugget boundary corresponded to each faying plane (and it might fail in cases in which the nugget boundaries were displaced from each other at the various faying planes), then it might be desirable to exploit a stereoradiographic technique which was developed early in this research. In this technique, two exposures are made, the X-ray tube being shifted an appropriate distance between the exposures. The resultant pair of X-ray views of the spot weld can then be viewed through a stereoscope to obtain a three-dimensional image of the spot weld (see Fig. 18). With such viewing, the high contrast features of the radiograph, such as images of cracks and voids, appear to stand out clearly in their proper depth relative to one another. The actual progress of a crack through the spot-weld nugget can be visualized, and its location with respect to the sheet surfaces may be estimated. With good radiographic technique, the same information might be obtained from the radiographic dark rings corresponding to the different faying planes in a multilayer spot weld. Other techniques might also be suggested for the solution of this problem.

Concluding Remarks

Results of the preceding tests showed that spot-weld radiography is feasible throughout the range of sheet thicknesses commonly spot welded in the aircraft industry, and reliably indicates the strength, structure, size, shape and defects of spot welds in all gages from 0.016 to 0.188 in. As the sheet thickness increases, the exposure voltage increases, the exposure time increases and the radiographic quality improves. With large welds in thick sheets, many details of structure and segregation appear clearly, while for the thinner gages, these features may be obscured by the limits of definition and contrast inherent in the X-ray film. There is no apparent upper limit to the thickness of aluminum alloy sheets in which spot welds can be radiographed successfully with commercially available X-ray equipment and film. Static shear strength and weld properties were revealed as clearly for dissimilar thickness combinations as in equal layer combinations. In all of the gage combinations encountered in aircraft factory tests, in which the output of 40 spot-welding machines was radiographed continuously in one factory, no difficulty was found in correlating weld properties and strength with the radiographic indications. These included many three-layer

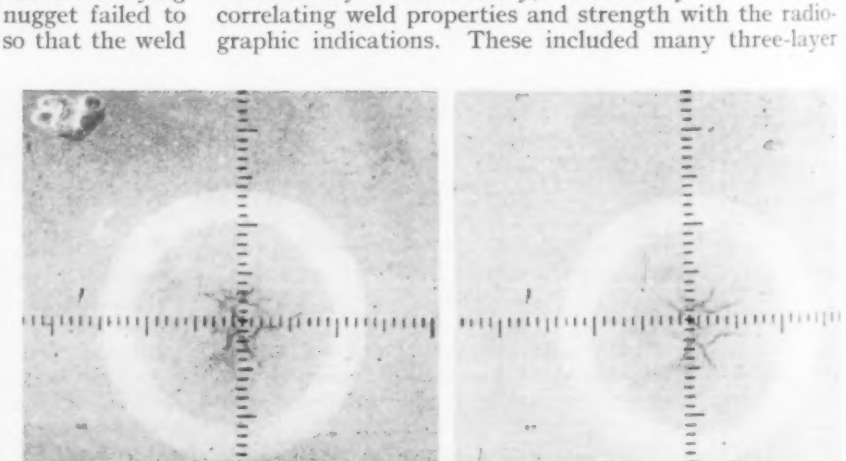


Fig. 18—Stereoradiographs of a Spot Weld with Nugget Cracking (4 ×)

combinations of dissimilar thickness sheets. Dissimilar sheet thickness combinations spot welded in industry offer no particular limitation to the usefulness of spot-weld radiography.

Acknowledgments

This paper is based on Appendices III and V of Part II of the Final Report on NDRC Research Project NRC-56, dated September 1, 1944.[6] The research was carried out during the period from May 1943 to September 1944, at the California Institute of Technology. It was sponsored by the National Defense Research Committee and supervised by the War Metallurgy Committee. Professor F. C. Lindvall was the official investigator. The authors were assisted by C. C. Woolsey, metallurgist, J. W. Smith, X-ray engineer, Mrs. Edythe Dial, photographic supervisor and C. E. Weaver, M. E. Breen, D. L. Bashore, G. M. Lansdell, C. L. McWade, L. J. Maguire, M. Cooke, J. E. Haskell and A. Burdorf during the period of this research.

The cooperation and assistance of the following industrial X-ray laboratories, X-ray equipment manufacturers and aircraft manufacturers are gratefully acknowledged:

1. Triplett and Barton, Inc., Burbank, Calif.
2. The X-Ray Products Corp., Los Angeles, Calif.
3. The Consolidated Vultee Aircraft Corp., San Diego, Calif.
4. The Consolidated Vultee Aircraft Corp., Downey, Calif.
5. Northrop Aircraft, Inc., Hawthorne, Calif.
6. The Douglas Aircraft Co., Inc., Santa Monica, Calif.
7. The Lockheed Aircraft Corp., Burbank, Calif.
8. The Ryan Aeronautical Corp., San Diego, Calif.
9. The Rohr Aircraft Co., San Diego, Calif.
10. North American Aviation, Inc., Inglewood, Calif.
11. Rheem Manufacturing Co., Southgate, Calif.
12. Picker X-Ray Corp., New York, N. Y.
13. General Electric X-Ray Corp., Chicago, Ill.
14. Westinghouse Electric Corp., X-Ray Division, Baltimore, Md.
15. Machlett Laboratories, Inc., Springdale, Conn

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(Continued on page 35)

Resistance Welding of Spring Steel to Low-Carbon Steel*

By Arthur Willink†

DURING the war and immediately subsequent thereto, the production of small malleable castings was far below the demand. For many years malleable castings were used in making snaps such as are normally used in harness hardware and during the war on many items of military equipment. Figure 1 (*a*) shows such a snap.

In order to meet the demand, a substitute design using wire and strip stock was evolved. In this case a hook was made from No. 3 soft basic steel wire on a wire-forming machine. In a second operation a nose and flat heel about 0.090 in. thick, together with a suitable fulcrum for the spring, were swaged. A third operation pierced a hole in the flat heel for a rivet. A loop was pierced and blanked from 0.090-in. thick mild steel strip stock. A spring was cut and pierced from coiled strip spring stock, 0.028 in. thick, about 0.85% carbon heat treated and rolled to a Rockwell "C" hardness of about 47. The three pieces were assembled with the spring between the loop and the flat heel by means of a rivet. An assembled snap of this type is shown in Fig. 1 (*b*).

Resistance welding, if it could be successfully applied, offered a means of improving the product and lowering the cost of manufacture. The use of a rivet and the third operation on the hook would be eliminated and there would be only three pieces to handle on the assembly instead of four.

A 15-kva. spot welder was arranged with a fixture on the lower electrode to hold the components of the snap in their proper relative position. The foot treadle was removed and replaced with a stub treadle that was operated with an air cylinder having a self-contained control valve. The exhaust was used to eject the completed snap by blowing it from the fixture. The timing was controlled with an electronic timer. A view of the setup open is shown in Fig. 2 and closed in Fig. 3.

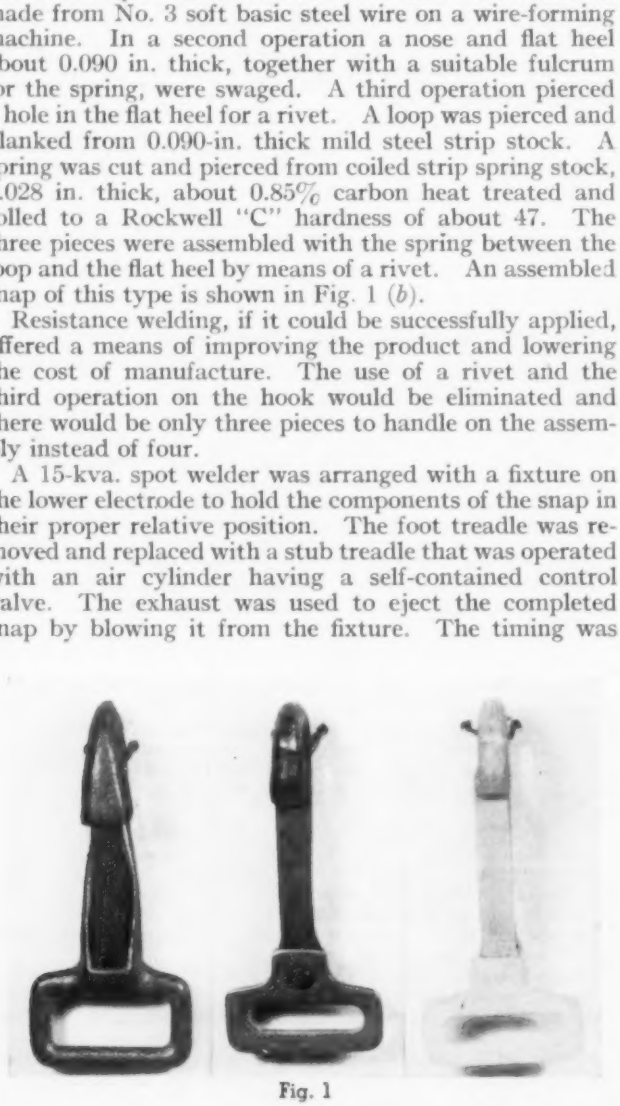

Fig. 1

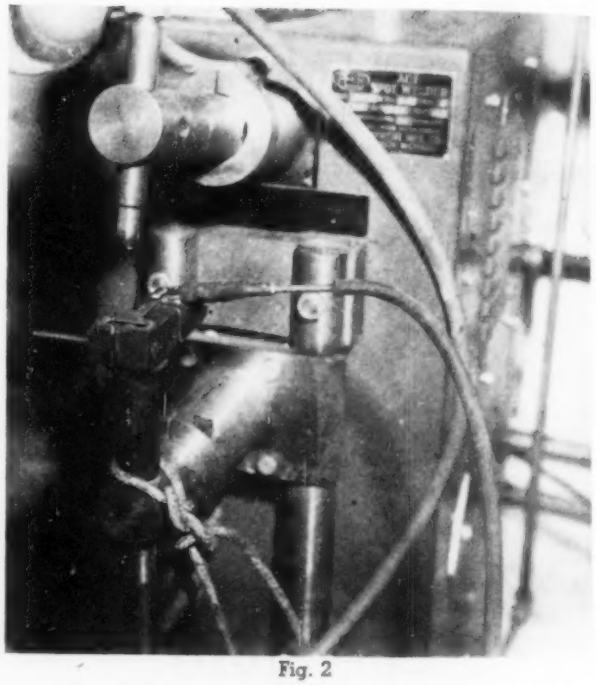

Fig. 2

The first trials were made with about 650 lb. of welding pressure between the electrodes, on the lowest heat with a pulsation weld of four 12-cycle welds with a cool time of 6 cycles between. The results were not too encouraging as the springs became brittle causing them to break and render the snap unserviceable. Heating subsequent to the welding operation was tried but without success. Separate heat treatment was tried and it resulted in soft unserviceable springs.

Taking the point of view of basic metallurgy a study was made of what occurred during the welding cycle. The spring at the weld and the immediately surrounding metal was at welding heat well above the critical temperature immediately upon completion of the weld. The water-cooled electrodes, however, exerting pressure upon the work withdrew heat so rapidly from the work after the welding current shut off, that they acted as a drastic quench before the work could be ejected from the machine. The solution to the problem lay in ejecting the work from the machine with the temperature at the weld well in excess of the critical and surrounded by a suitable volume of metal also above the critical temperature.

Increasing the welding current and/or the welding time did not bring about the desired condition stated above but produced burning. This burning caused the severance of the spring. By decreasing the welding pressure

* Presented at Twenty-Seventh Annual Meeting, A.W.S., Atlantic City, N. J., week of Nov. 17, 1946.

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Fig. 3

Fig. 4

to about 350 lb., it was found that a weld was made of ample strength for the purpose intended without burning. In addition, the work was ejected with the spring temperature well above the critical temperature at the weld, and enclosed in a "sandwich," so to speak, likewise above the critical temperature. On cooling in air this arrangement gave excellent properties to the spring and produced a highly satisfactory product. A welded snap is shown in Fig. 1 (*c*).

Referring again to Figs. 2 and 3 it will be noted that the upper electrode is channeled, the thought being to concentrate the weld on the outside of the joint. It was found later, however, that a flat electrode using four 15-cycle welds with 6-cycle cooling periods between gave every bit as good results as the channeled electrode with four 12-cycle welds with 6-cycle cooling periods. The flat electrode permits of greater ease in setting up and less maintenance.

Figure 4 shows a view of typical welded snaps given severe punishment by being twisted and bent in a vise. The springs remain intact and the snap can be twisted back into shape and be serviceable. The welded snaps are the strongest of this type, both the malleable and riveted snaps would fail under the conditions shown in Fig. 4.

Later, a problem presented itself where the "sandwich" design could not be used, in other words, the spring must be welded to the low-carbon steel with one face of the spring in direct contact with the welding electrode. Again in this case a low welding pressure was used, the mild steel was in contact with the lower electrode and the spring in contact with the upper electrode. By means of a solenoid attached to the air valve controlling the air cylinder operating the spot welder, the operation of the upper electrode was controlled by the electronic timer. This was set in such a way that the upper electrode was released the *instant* the welding operation was completed. This precluded any drastic quenching action on the part of the water-cooled electrodes.

In conclusion, it may be stated that spring steel can be, and by the methods enumerated, has been successfully welded commercially to low-carbon steel. The main prerequisite is to prevent in some way, the drastic quenching action of the water-cooled electrodes in tight contact with the work due to the pressure. In the examples cited in this paper the spring was entirely surrounded at the weld by metal well above the critical temperature when ejected from the machine in one case, and in the other the electrode was removed before it had a chance to do any quenching.

It is hoped that the experiences and results related in this paper may be helpful and adaptable to other problems that arise as the field of resistance welding broadens to include many new applications.

Low-Alloy, High-Tensile Steels, Their Properties, Workability and Weldability*

By George M. Huck†

DURING the last several years most of the major steel companies have been producing steels that are known as the low-alloy, high-tensile group.

The objective of this development was to meet the demand of fabricators for a stronger steel, so as to permit the use of lighter sections by increase of unit stresses and higher resistance to atmospheric corrosion.

These steels, in general, have a yield point of 50,000 psi. minimum and a tensile strength of 70,000 psi. minimum, compared to A.S.T.M. A-7, the standard steel for bridges and buildings having 33,000 psi. minimum yield point and 60,000 psi minimum tensile strength.

The maximum stresses in structural members without plastic yielding are limited by the yield strength of the material. The final percentage of elongation within which fracture occurs, together with the percentage of reduction of area, provides information as to the ductility and predicts in part, its workability and performance in service.

An important advantage of the low-alloy, high-strength steels over mild steels is the higher working stresses that can be used without danger of failure of plastic yielding. Having a minimum yield strength of 50,000 lb., the low-alloy, high-strength steels are about 50% stronger than A.S.T.M. steel A-7 with 33,000 lb. minimum yield strength. This increase in yield strength permits a reduction in weight of structural members.

Since the yield points occur at higher unit stress for this group than for the carbon steel A-7, it is evident that with the same factor of safety a higher designing unit stress is justified in proportioning members when a low-alloy, high-strength steel is used having these properties.

As an example, let us take a simple case of a tension member to illustrate the advantage of low-alloy, high-tensile steels. A factor of safety in common use in certain fields has a value of 1.833 which is applied to the yield point. The A-7 carbon steel has a yield point of 33,000 lb. and assuming a total stress of 54,000 lb. in tension, the member would require an area of 54,000/18,000 or 3.00 sq. in. When a steel with a yield point of 50,000 lb. is used the area is 54,000/27,000 = 2.00 sq. in. Therefore a saving of 1 sq. in. or 33% is made by using a low-alloy, high-strength steel in place of A-7 carbon steel.

In compression members, savings as

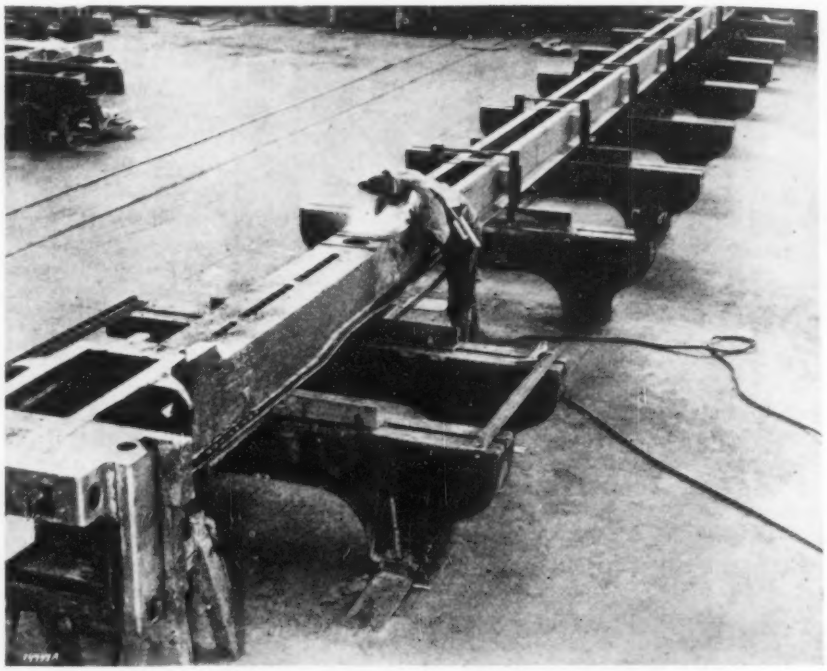

Fig. 1—Welding Underframe for De Luxe Railroad Coach

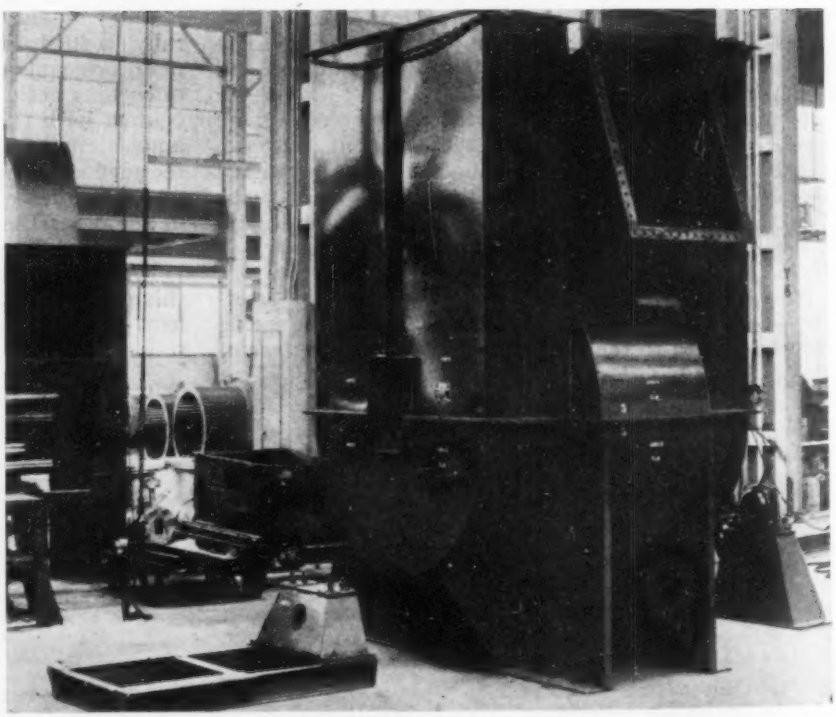

Fig. 2—Housing for Fan Used in Handling Sulphurous Gases in Metallurgical Plant

* Presented before Puget Sound Section, AMERICAN WELDING SOCIETY, Feb. 26, 1946.

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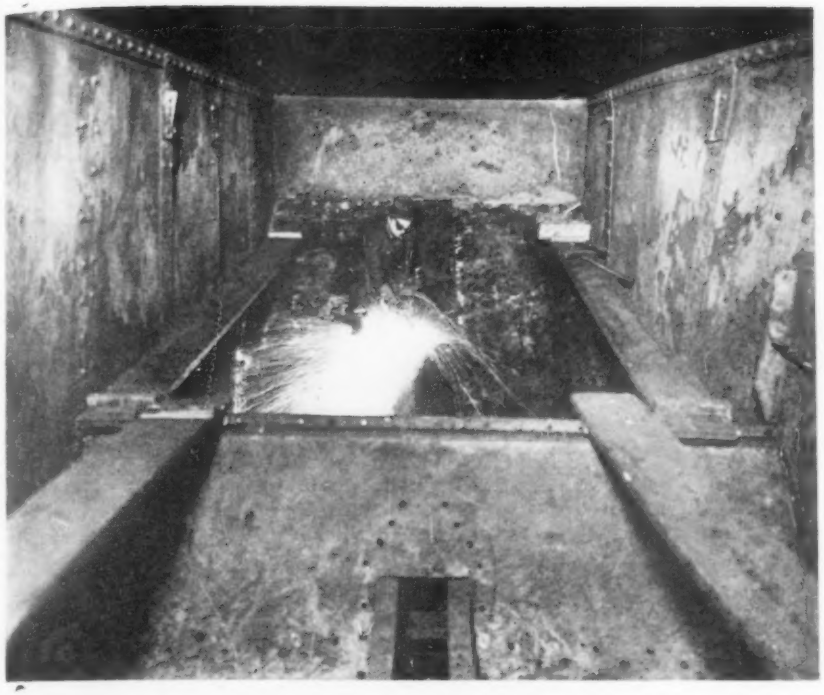

Fig. 3—Freight Car Construction

high as 33% are not always obtainable; this is well known by engineers, since, as the slenderness of such members increases the allowable compressive unit stresses converge toward a common value regardless of the yield points of the various steels.

In the case of members subject to bending where deflection is an important consideration, it must be remembered that for a given load and span with depth of member remaining the same, the deflection will be proportional to the unit stress since the modulus of elasticity is nearly the same for all grades of steel Therefore the higher working stresses allowed for the low-alloy steels will result in greater deflections than those with A-7 structural steel members. Under this condition the full economy of the low-alloy steels cannot always be obtained.

The fatigue and endurance limit values of steels are of prime importance in many structures, therefore in such cases the working unit stresses should be based upon the endurance limit when it is less than the yield strength of the steel. Members subject to fatigue should be given careful attention with the aim of avoiding abrupt changes in section, small fillets and other "stress raisers."

In this connection it may be stated that for low-alloy, high-tensile steels the ratio for endurance limit is frequently over 70% of the tensile strength, therefore a working range of 60 to 70% would be considered as normal expectancy for these steels, whereas for the ordinary structural steels 45 to 55% is generally used in determining the unit work ng stress.

Mayari "R" Steel

Bethlehem Steel Company produces a low-alloy, high-tensile steel that is marketed under the trade name of Mayari "R" (pronounced to rhyme with "fiery.") "R" denotes rust resistance.

For many years Bethlehem produced alloy steels known as Mayari steels from natural alloy-bearing ores, and Mayari R is an extension of this series to meet the later demands for a low-alloy, high-tensile steel.

The need for a stonger steel which originated chiefly in the transportation field, included the following basic requirements:

(*a*) It must have greater strength so as to permit higher unit stresses and therefore lighter sections.

(*b*) It must have high atmospheric corrosion resistance. When greater corrosion resistance is provided with the lighter section used it is rarely necessary to make allowances for corrosion.

(c) It must have good formability, hot or cold, and be readily welded in the as-rolled condition without air hardening appreciably.

The chemical composition of Mayari R is as follows: carbon, 0.12 max.; manganese, 0.50–1.00; phosphorus, 0.08–0.12; sulphur. 0.05 max.; silicon, 0.10–0.50; chromium, 0.40–1.00; nickel, 0.25–0.75; copper, 0.50–0.70.

Typical properties of sheets and plates made from Mayari are as follows:

	Yield Point, Psi.	Tensile Strength, Psi.	Elongation % in 8 In.	Brinell No.	Bend Test
14 gage	52,600	70,400	23.3	145	Flat
3/16 in.	57,600	71,900	28.0	137	Flat
3/8 in.	58,200	78,400	28.0	156	Flat
1/2 in.	54,900	78,400	25.5	152	Flat

Important Features

1. Mayari R has greater strength—having a yield point of 50,000 psi. minimum, which is about 1 1/2 times the yield point of grade A-7 steel.

2. It also has a high endurance limit of 50,000 psi., permitting the safe use of higher working stresses where reversal of stresses, repeated loading and unloading or vibrations are encountered in service.

3. This steel has five or six times greater atmospheric corrosion resistance than mild carbon steel and two to four times that of copper-bearing steel.

4. Its greater strength and increased corrosion resistance allow substantial weight saving.

5. It has much greater resistance to abrasion than mild carbon steel.

6. It has excellent paint adherence, much better than plain structural steel.

7. It has unusual resistance to battering and denting and is equal to carbon steel that has one third greater thickness.

8. Its workability is accomplished with same methods used for carbon steels.

9. It can be as readily welded as structural steels by all methods of electric or gas welding.

10. It retains its high strength characteristics at moderately elevated temperatures.

Bethlehem carried on atmospheric exposure tests over several years on some 15,000 specimens of its low-alloy, high-strength steel and other steels. The samples were exposed in industrial atmospheres, in rural districts and along the sea coast in widely separated localities.

While some variations in the corrosion are found in different locations, all tests have definitely confirmed the superior corrosion resistance of the low-alloy, high-strength steel which protects its increased strength.

Mayari R is a workable steel. It can be hot and cold pressed and fabricated with the regular shop equipment used for plain carbon steel. It is difficult to lay down any fixed rules for this steel as so much depends on the available equipment and experience of the fabricator.

A few observations can be cited to show the slight differences in behavior of ordinary carbon steel and alloy steels.

1. Generous radii in corners of pressed parts are desirable when working with alloy steels.

2. The higher yield-point steels have slightly more springback than does carbon steel of structural grade. An experienced fabricator will readily make forming die correction to reduce or eliminate the increased springback.

3. Punching is limited to a lesser thickness than structural carbon steel. Drilling and reaming operations are best done at lower tool speeds. As alloy steel is tougher and harder the cutting and punching tools should be kept in good conditon.

The important point is that, in general, Mayari R can be fabricated in the same

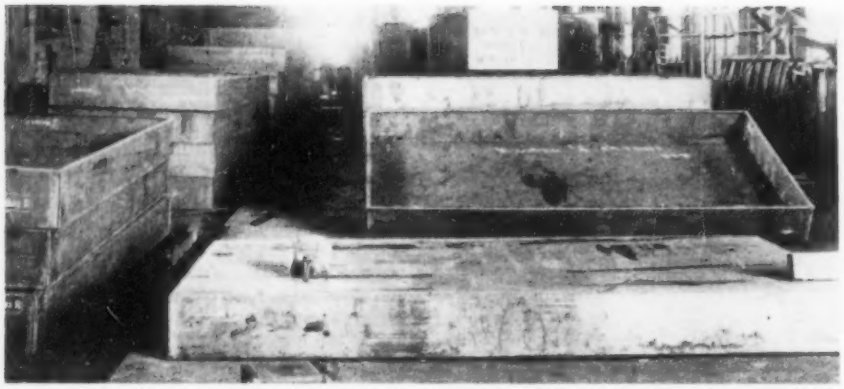

Fig. 4—Dye Vats for Chemical Plant

manner as mild carbon steel with only minor variations to allow for its higher physical properties.

Welding

Low-alloy, high-strength steel is readily welded by all the usual methods of gas and electric welding, such as electric resistance, electric arc, automatic submerged melt and gas welding.

It is classed as a non-airhardening steel and exhibits no appreciable hardening from temperatures usually encountered in welding or fabrication. The thicker sections of $^3/_4$ in. or more may require preheating when welded below room temperature or when fabricating dynamically loaded structures.

Equipment and structures made of this steel are readily repaired by welding in the field without affecting their strength, if the same precautions are followed as when welding plain carbon steels. This is important in the case of large structures which cannot be furnace annealed but can be torch preheated when thick sections are involved in the assembly. Preheating is recommended to reduce temperature gradients.

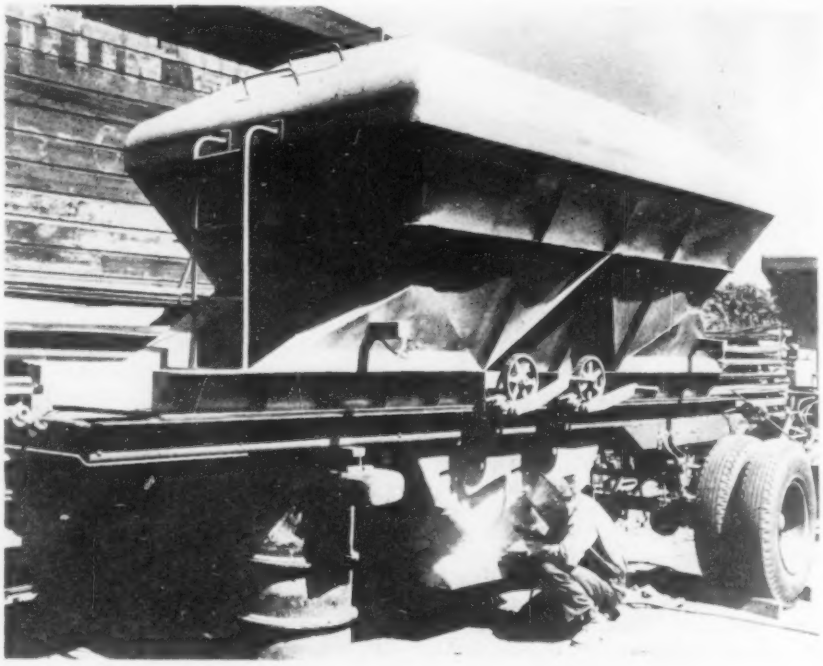

Fig. 5—Bulk Cement Delivery Truck

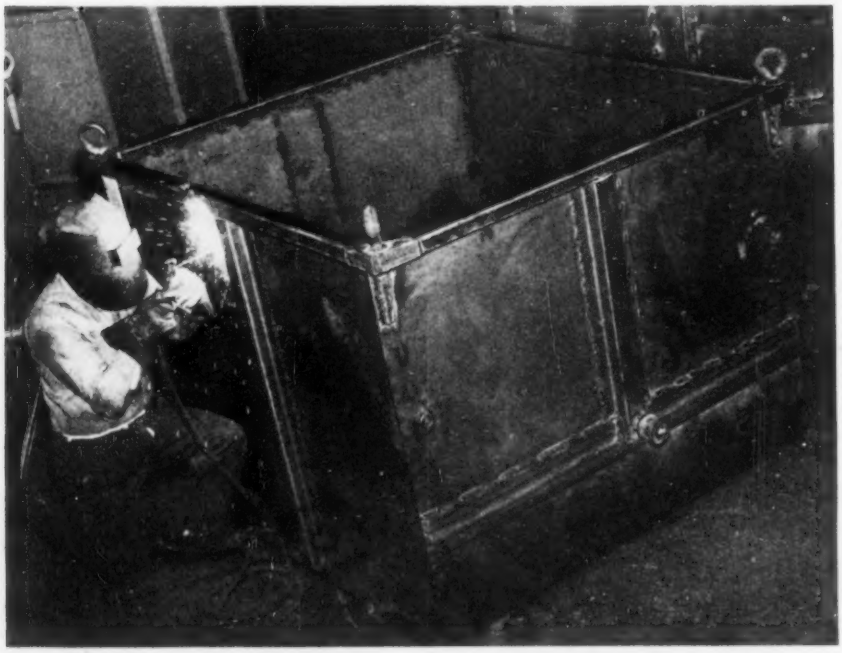

Fig. 6—Constructing Refuse Container

When welding low-alloy steel with single-pass welds or where the weld metal reinforcement is not removed a plain carbon steel shielded-arc electrode is recommended because the weld metal "picks up" alloy content from the metal melted during the welding. Where the weld reinforcement is removed and where full strength of the weld must be retained special electrodes may be used. These higher strength electrodes can be obtained from most of the electrode manufacturers.

In gas welding, a higher strength rod than is ordinarily employed for mild steel should be used.

While, as already emphasized, this steel can be readily welded by all of the electric and gas-welding methods, it is not recommended for hammer-forge welding because no suitable flux has been developed for making welds by hammer forging.

On all-welded construction whether low-alloy or mild steel is used, consideration should always be given to the design of the structure and strength required in the welded joints.

Electric Resistance Welding

Mayari R can be spot, seam and flash butt welded without difficulty as it is welded by these processes as easily as mild steel. The surface condition of the steel in spot and seam welding is of prime importance in the making of quality welds. It is poor practice to try to weld through grease, paint, heavy scale or rust. A thin coat of oil does not seem to cause bad results but for optimum weld quality the surface portions in contact should be degreased before welding. Shear tests on spot welds are substantally higher than on comparable mild steels.

Availability

Mayar R is available in a complete range of sizes, in plates, shapes, bars, bar

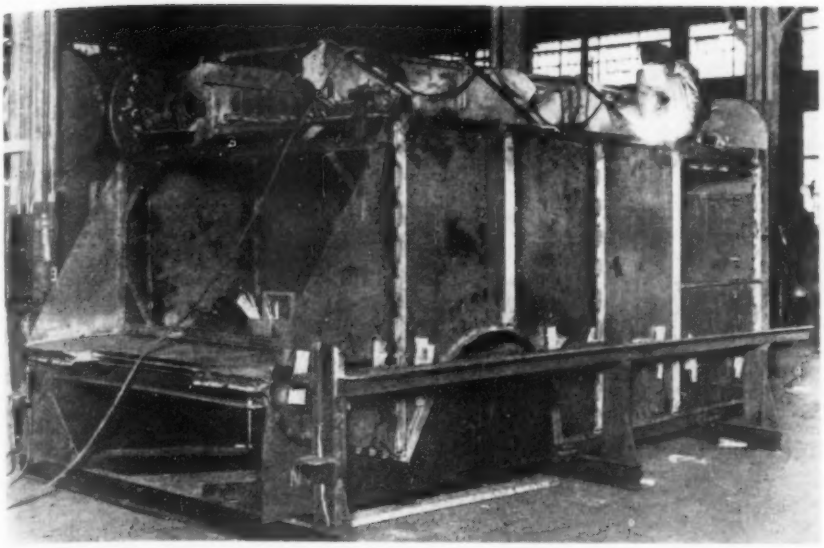

Fig. 7—Welding Steel Body for Special Type Truck Used in Garbage Disposal

shapes, sheets and strips. This variety of forms makes it possible to use this high-strength, corrosion-resisting steel for fabricating complete units. Uniformity of design is thus assured.

Mayari R has the approval of 44 major railroads, 37 states, U. S. Army Engineers (Spec. T-1234-A), U. S. Army (Spec. 57-114-1-Class B, grades 1 and 2), U. S. Navy, U. S. Marine Corps, Department of Reclamation, Panama Canal Authority, Federal Bureau of Roads, Transit Research Corp., American Bureau of Shipping, Lloyds Register, and numerous manufacturing concerns. It conforms to specification A242 Low Alloy Structural Steel of the American Society for Testing Materials.

Following is a partial list of Mayari R applications:

Argricultural—Farm buildings, silos, tractors and implements.

Automotive—Trains; coach, trolley, bus and trailer bodies. Tank trucks, dump trucks, mixer trucks, mufflers, fuel tanks, fenders and bumpers.

Building—Structural members, partitions, roofs and stacks, skylights, sash, door frames and gratings.

Chemical Industry—Tanks, vats, mixers conveyors.

Containers—Drums, milk cans, refuse cans, trash baskets, soup kettles.

Conveyor Equipment—Elevator buckets, drag lines, chutes, screens.

Dams— Grates, slides, racks, grating, facings.

Excavating Equipment—Buckets, booms, frames for power shovels and cranes.

Industrial Equipment—Power plant equipment, coal bunkers, roofs, stacks and breechings, annealing-box covers, wire and cable reels and seamless tubing.

Mil tary Equipment—Bailey bridges, "water buffaloes," gun mounts, mine-laying cranes, trucks.

Mining—Cars, hoists, skips, cages, loaders, tipples, washes, agitators, safety ladders, chutes, screens, dust collectors.

Paper Manufacture—Digester tanks, diffusers, log chains.

Petroleum—Tanks and containers, tank trucks, refinery equipment.

Railroads—All types of cars, coaling stations, bridges.

Road Equipment—Wheel scrapers, bulldozers, graders, trail cars, snow plows, power shovels and ditchers.

Shipping.—Decks, deck houses, tank tops, stacks, bulkheads, partitions, furniture, barges, yachts, motor boats, ferries, tankers and piers.

(*Continued from page 29*)

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Announcement of the Final Report of the Board to Investigate the Design and Methods of Construction of Welded Steel Merchant Vessels*

By Rear Admiral Harvey F. Johnson, USCG(Ret.)†

I HAVE come here this afternoon at the request of the AMERICAN WELDING SOCIETY to announce to you the forthcoming publication of the final report of a Board which was appointed by the Secretary of the Navy to investigate the circumstances surrounding certain structural failures, exclusive of battle damage, that were experienced by welded merchant vessels, and to mention briefly some of the findings considered to be outstanding by the Board.

The investigation of the Board was in progress for more than three years. During that time two interim reports have been made to the Secretary of the Navy. Both of these reports have been published in the JOURNAL of your SOCIETY. A final report covering the Board's activities has been submitted to, and approved by the Secretary of the Navy. The manuscript of this report is now in the hands of the Government Printing Office and it is expected that copies will be available in the near future.

Early in the war welded merchant vessels experienced structural difficulties in the form of fractures which could not be explained. These fractures, in many cases, manifested themselves with explosive suddenness and exhibited a quality of brittleness which was not ordinarily associated with the behavior of a normally ductile material such as ship steel. It was evident that the implications of these failures on welded ships might be far reaching and have a signal effect upon the war effort.

The use of welding in the construction of merchant vessels during the war permitted the launching of an enormous fleet of ships which played a vital part in winning the war. There are, however, certain disadvantages connected with welding which were not fully realized at the outset. Although the technique of depositing weld metal and the application of welding sequences to minimize shrinkage, distortion and cracking were fairly well understood, relatively little was known of deleterious conditions accompanying the welding process on large ship structures. Consequently when fractures in all welded steel merchant vessels first began to manifest themselves (as in the Schenectady and Esso Manhattan) conditions were found which did not conform to previous experience. There was a general feeling that the accelerated shipbuilding program and the concomitant quantity production of all welded ships had resulted in a general disregard for proper construction practices and workmanship. It was particularly felt that insufficient care was being devoted to welding sequences with the result that locked-in stresses were present in many ships to a higher degree than would be expected. The presence of these higher stresses was considered to be an important factor in the incidence of the observed fractures.

The results of the investigation, however, have not substantiated this belief. Rather, the Board concluded that the fractures in welded ships were caused by notches built into the vessels either through design or as the result of workmanship practices and by steel which was notch sensitive at operating temperatures. When an adverse combination of these factors occurs, the ship may be unable to resist the bending moments of normal service.

The seriousness of the structural failure problem may be gauged by the fact that during the period of the investigation, out of approximately 5000 ships considered, about one-fifth sustained casualties. Of these casualties, 127 were classified as serious. Eight vessels were lost but it is extremely fortunate that only 26 persons lost their lives. Contrary to widespread belief, the fracture menace did not confine itself to Liberty ships but involved vessels of all types.

The over-all designs of all types of vessels were checked by recalculation of the longitudinal strength and by means of static structural tests on certain vessels. It was found that there was a margin of strength in every case over that required by existing standards and that the basic analytical method used in calculating the strength of the hull girder is valid.

In the investigation of detail design it became apparent that the monolithic character of the welded ship resulting from the method of fabrication can produce joints, particularly at structural discontinuities, that have high stress concentrations and severe restraint, thereby tending to inhibit plastic flow. This condition did not exist generally in the riveted ship. The danger at high concentration at points of structural discontinuity in the welded ship is further aggravated by welding usually present at such points. Every fracture examined started in a geometric discontinuity or notch resulting from unsuitable design or poor workmanship.

The investigation pertaining to structural details has strongly emphasized that too much attention cannot be paid to the elimination of discontinuities or notches, whether they be small or large, and that the effect of discontinuities is aggravated by welding.

During the course of the inquiry many research projects were initiated under the National Defense Research Committee to investigate the behavior of ship steel. These projects were carried out under the supervision of the Welding Division of the War Metallurgy Committee. In utilizing the facilities of the War Metallurgy Commit-

* Presented at Twenty-Seventh Annual Meeting, A.W.S., Atlantic City, N. J., week of Nov. 17, 1946.

† Chairman of the Board.

tee, the Board was able to bring to bear on its problems some of the best scientific minds in the country. Through the supervision of the War Metallurgy Committee a complete coordination of effort in research was achieved and results were obtained in a minimum of time. Close liaison was maintained throughout the investigation with the British, and with other Allied Nations who are concerned with the operation of welded merchant vessels.

Other studies indicated that steel as furnished to shipyards complied in every respect with present physical requirements. In spite of this, impact tests of steel samples taken from vessels which had suffered fractures indicated that in many cases the steel was notch sensitive. In addition, it was found that some steels furnished to shipyards were also notch sensitive. There is a necessity for the establishment of a new specification to include a practical test for the evaluation of the notch sensitivity of commercial steels.

There is no indication that inferior quality or misapplication of welding electrodes was responsible for welded ship fractures. This does not mean, however, that an improvement in electrodes and covering materials might not be beneficial.

The feeling that workmanship had suffered due to the pressure of wartime production programs was substantiated. The importance of maintaining adequate standards of workmanship has been clearly established by the analysis of structural failures in the past three years. Poor workmanship engenders fractures, since a fracture may originate at a small notch such as is occasioned by peened-over cracks, by under-cut welds, by porosity and inclusions in the weld, or by "saddle" welds, resulting from incomplete penetration, which leave voids at the center of the joints. High quality workmanship is still an important need in the building of welded ships.

Although a large amount of work has been accomplished in the investigation of residual and of locked-in stresses resulting in a considerable extension of knowledge in this respect, no evidence has been found to indicate that these stresses are important in causing the fractures in welded ships.

A study of operating conditions resulted in the finding that loading and ballasting procedure did not create abnormal bending moments.

The wartime operation of cargo ships in convoys and overseas routes which are only infrequently used in normal times imposed unusual hardships on the vessels, especially during the early part of the war when convoys were being routed through extremely cold waters where heavy seas prevailed during the winter months. The highest incidence of fractures occurred under the combination of low temperatures and heavy seas. The risks involved were accepted as far as heavy seas were concerned, but at the start the adverse effects of low temperature were not fully appreciated. When these facts were recognized, vessels modified to increase their resistance to fracture were assigned to the more rigorous trade routes.

The program conducted in connection with the investigation has produced at least partial answers to most of the more urgent questions and has given an adequate solution for the purposes of the Board. It now becomes necessary to assure the continuance and extension of this work. Paths have been indicated along which real improvement can be made in structural design, materials and fabrication methods. The Board has been dissolved —it cannot follow these leads. However it is important that we maintain our present position in maritime affairs and protect our standing in world wide competition by continuing fundamental research work on design and methods of construction of steel ships. Accordingly, the Secretary of the Treasury has appointed a Committee to carry on the work of the Board. It has been designated as the Ship Structure Committee. This Committee is jointly controlled and financed by the agencies which comprised the Board, namely, the Bureau of Ships U. S. Navy, the U. S. Coast Guard, the U. S. Maritime Commission and the American Bureau of Shipping.

* * *

The serious epidemic of fractures in the steel structure of welded merchant vessels has been curbed through the combined effect of the corrective measures taken on the structure of ships during construction and after completion, improvements in new design, and improved construction practices in shipyards.

The results of the investigation have vindicated the all welded ship. The statistics show that the percentage of vessels sustaining serious fractures is small. With proper detail design, high quality workmanship, and a steel which has low notch sensitivity at operating temperatures, a satisfactory all-welded ship structure may be obtained.

However, until experience can be had with vessels constructed under normal conditions, of improved design, materials and workmanship, some form of crack arrestor, such as a riveted gunwale angle should be incorporated in the hull girder of all large welded vessels.

The mechanism of fracture is still not clearly understood but the investigation has yielded much new information and has contributed to the solution of the problem of why welded ships have failed.

THE AMERICAN WELDING SOCIETY

ACTIVITIES – RELATED EVENTS

A MESSAGE FROM PRESIDENT DELHI*

It is with considerable humbleness and no little fear that I appear before you today as the newly elected president of the AMERICAN WELDING SOCIETY.

Both emotions, or if you prefer, both reactions develop from the decision on the part of the SOCIETY's policy makers to nominate and endeavor to elect a president from the far west; and second, because of all the many qualified and capable proponents in the art of welding available on the Pacific Coast, they should decide to choose me as a special envoy from that area.

Third, I wonder how any person, whether from the West, South, North or East, could with equanimity honestly feel he could satisfactorily discharge the duties of the presidency of the SOCIETY. These manifold and arduous duties have been ably and honorably administered through 22 terms of office, beginning in 1919 with our dear Dr. Adams, continuing through a succession of very capable and learned gentlemen, and culminating in this past year of leadership under our co-director and esteemed friend, Dr. Hess.

This succession of distinguished presidents has established an extremely high standard of leadership which will be rather difficult to maintain.

While I am not insensible of the honor that has been accorded me, I fully realize it is not Lee William Delhi who is being honored, but the entire Pacific Coast area—an area that for 25 years has contributed to and supported the AMERICAN WELDING SOCIETY in all of its ramifications; an area that has sponsored welding as a technical process; an area that considers welding as the most modern method of metal fabrication, and a process now requiring entrance into scientific fields.

And an area which has expanded to unbelievable industrial limits during the war and since V-J Day, and now, more than ever before, offers the greatest possible opportunities for the expansion of the WELDING SOCIETY's activities.

An area which is proud and happy to have received the recognition of our own highly organized, and nationally important society.

We in the West, for 25 years have believed the nerve center of our SOCIETY to be here in the East—we must continue to feel that way. You have here a preponderance of the advanced educational institutions, the finest in the world, with their great research laboratories, their trained educators and talented graduates, all here at your elbow to faithfully serve your interests.

You have the most modern and progressive industrial firms in the world, in constant contact with you, ready to cooperate in the development and use of the technical procedures and the physical facilities, upon which the energy and intelligence of the membership of our SOCIETY have been, and are being expended.

We have some very fine educational institutions in the West, and a considerable number of progressive industrial firms, likewise a number of talented and hard-working welding engineers. There is not sufficient time to tell you about them today, therefore I now tender to each and every one of you present a warm invitation to visit us in the West and to see first hand what we have to offer. We will welcome you and extend every friendly courtesy to you, and endeavor to make your stay as enjoyable as our well-known hospitality permits.

It has been suggested that I make known to you at this meeting any change of policy or any new policies I might have in mind, having to do with the growth and welfare of our SOCIETY.

It has been suggested I discuss prospective action by the forthcoming administration. Both suggestions in my opinion have to do with closely correlated matters, and also conduct in office.

Well, be at ease. I would like to make it quite clear here and now, there will be no revolutionary changes—none. If evolutionary changes seem desirable, and they always are if we are to make progress, the democratic structure of our SOCIETY indicates that the necessary changes of policies stem from our membership, and by orderly procedure move to, and through, the proper committees, where a thorough examination into the merits or demerits of a suggested action will be made, and a screening of unsound recommendations will occur.

By the same orderly procedure, the recommendation will come before your board of directors for further consideration and, if approved, your very capable staff will be empowered to take the necessary action to make the recommendation effective, and you, the membership, will so be advised.

You can readily understand from the above that I do not consider it proper, nor do I feel the president has the right, to endeavor to dictate the policies of a SOCIETY such as ours.

The policies of our SOCIETY have been long established, its affairs have been ably administered. The membership has been basically and fundamentally responsible for existing policies. I believe, as an individual and as an officer of the SOCIETY, the existing policies to be sound—intelligibly so.

In pondering over the problems confronting an officer of the AMERICAN WELDING SOCIETY, it occurred to me that the best possible executive action would be to answer some of the questions that have been asked by our members, prospective members or the executives and managers of our sponsors or prospective sponsors.

Two of the questions most frequently asked are: One, what is a welding engineer? I do hope this question is answered some day. Two, what is the AMERICAN WELDING SOCIETY? Additional questions are, what is the sphere of influence of a welding engineer, and what is his value to a business? Also, is the AMERICAN WELDING SOCIETY a commercial society, created to sell products and produce profits? Is it a labor society, dealing with labor problems and negotiating union contracts? Is it a mutual aid society to secure employment for its members?

Or, is it a technical or scientific society? Your membership, past and present directors, officers and staff, have answered the last of these questions many times—emphatically so.

The AMERICAN WELDING SOCIETY is a technical society, the minutes of your directors' meetings have emphasized this over and over for many years. It is a technical society as widely and securely sponsored by as divergent a class of membership and business firms as any society which I, personally, know of.

Let us maintain our technical standing. Let us maintain our dignity. Let us strive to make our society more closely represent a scientific society. Let us protect the interests of our valued sponsors without whose help we could hardly exist, and without whose help we cannot hope to further progress.

It is to be hoped we will refrain from unseemly commercial practices; that we will make no radical change in our SOCIETY's structure; that we will oppose any radical change in our committees either in structure or personnel, whereby their technical progress may be hindered; that we oppose *any* action that tends to weaken the SOCIETY's technical standing.

It is my fervent wish that no great

* Delivered at the Annual Business Meeting, A.W.S., Nov. 22, 1946, Atlantic City, N. J.

"Help me *walk* again..."

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THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS

FRANKLIN D. ROOSEVELT, Founder

change occur in our key staff members who have so faithfully served us for approximately 27 years, who for over half their lives have given so freely of their time, energy and brains, and who have had a tremendous part in the founding and growth of our SOCIETY.

The directors and section chairmen know the board is seeking means to enlarge and strengthen our head office in order to better cope with the increased activities and responsibilities that are piling up.

Should this contemplated action in any way affect the present personnel, I strongly recommend:

(*a*) Suitable and responsible duties be apportioned this personnel; duties that will sustain their cherished pride; duties that will sustain their standing in technical circles, and duties that will utilize their great training and learning to the benefit of the SOCIETY.

(*b*) That suitable honors be bestowed upon the affected personnel; honors worthy of their labors; honors befitting the dignity of our SOCIETY.

(*c*) Only the *most highly qualified* person or persons, with technical and administrative abilities, be considered as additional staff members.

(*d*) That fair and adequate financial arrangements be approved, commensurate with services past rendered, and consistent with modern trends being established by progressive institutions.

These four points will, of course, be thoroughly studied by a committee appointed for that purpose, and we cannot at this time foresee exactly what action can be proposed.

On the other end of the spectrum, I will actively support every committee working for the betterment of our SOCIETY to the fullest of my ability. There is where activities take place that have either detrimental or beneficial effects upon the welfare of our SOCIETY.

We cannot say that any one committee is more important than another. They all are important. At the moment our membership committee is in dire need of assistance. It is to be hoped that every section chairman, every regional vice-president and every individual member will go home from this convention and bring in just one worthy and qualified new member and a new sponsor, using the technique advanced by the speakers at the Section Activities meeting Wednesday evening for creating more interesting meetings, securing better speakers, pictures and papers to interest old and new members.

I trust that every sponsor can go home and advise his associates regarding the activities of our SOCIETY; advise them of the continued growing importance of our SOCIETY in the fields of industry; advise them of the tremendous commercial value of the research work being carried on by the Welding Research Council; advise them regarding the national recognition of the SOCIETY's membership on the many code committees, and its affiliation and cooperation with other national and international societies, toward the end that we continue to receive their wholesome and liberal support.

Finally, and very important, have pride for your membership in the AMERICAN WELDING SOCIETY. It honors you.

ANNUAL MEETING

The twenty-seventh Annual Meeting of the AMERICAN WELDING SOCIETY was held in Atlantic City during the week of November 17th. It was a successful meeting and in many respects surpassed all previous meetings. There were more technical papers and more technical sessions than ever before held in the history of the SOCIETY. The attendance, well over 1200, was considerably less than in recent years, but this was expected because of the absence of local attendance which prevails in large cities. There were several foreign visitors including repre-

(*Continued on page 44*)

Why Weld Blind ?
● Would you take a chance on running out of acetylene in the middle of a welding or cutting operation? Cylinder gages show you only the available pressure and this pressure holds up until the last few feet. Therefore if you are using "bottled" acetylene you are welding blind.
With a Sight Feed Acetylene Generator a glance at the hopper will tell you instantly how much acetylene you have available. Look at the hopper, it is Pyrex, you look through it, not into it. The carbide is always visible.
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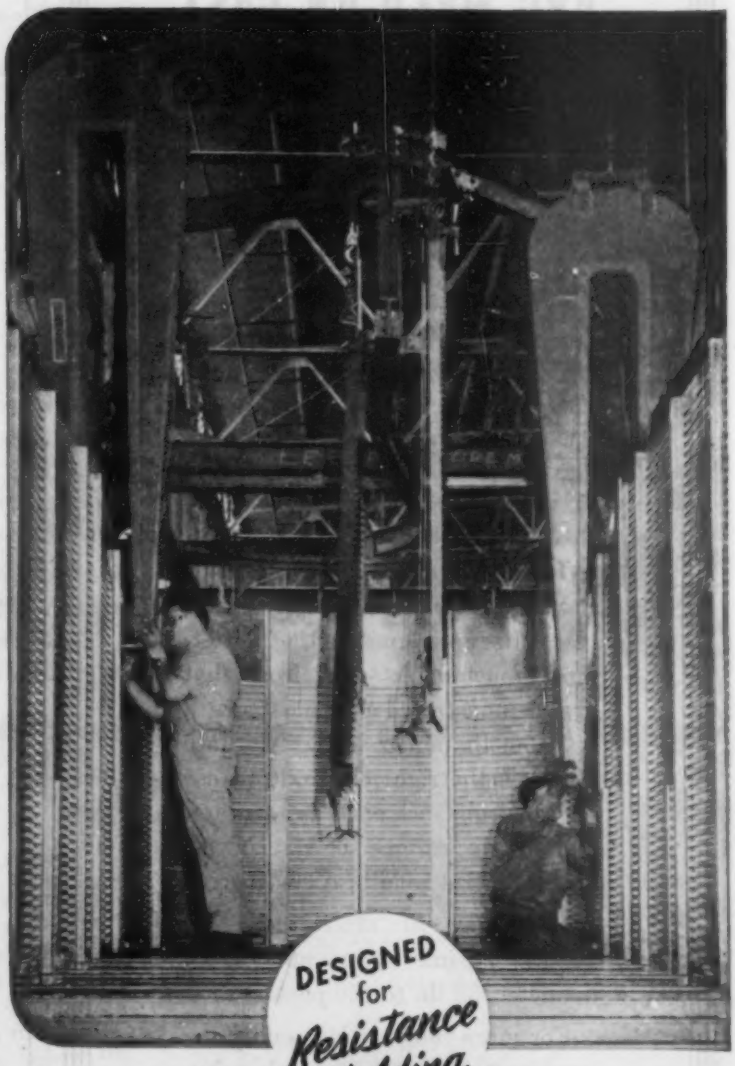
ACETYLENE Sight Feed GENERATORS
THE SIGHT FEED GENERATOR COMPANY
RICHMOND, INDIANA

There really wasn't any other way to design them—



DESIGNED for *Resistance Welding*

When Fruehauf designed its now famous stainless steel truck-trailer it went after real mass production: not just a couple of hand assembled trailers a day—but a complete trailer off the line every 45 minutes.

There were two ways to do a job like that. Either Fruehauf could build enormous plants with many assembly lines and use relatively slow equipment—or it could design the trailers for assembling by resistance welding from stem to stern, from roof to undercarriage.

Since the latter enabled Fruehauf to turn out highest quality trailers faster and at lower cost, there wasn't any real question in the end. Every one of these Fruehaufs rolling off the line is doing so through benefit of Progressive welding guns—push guns, scissors guns, C-type guns, little guns and big ones like those shown here.

Progressive's engineers will be glad to help you design your products so that they can be built better, faster and at lower cost with resistance welding.

IT PAYS TO WELD

PROGRESSIVE *Welder Co.* 3050 E. OUTER DRIVE • DETROIT 12

RESISTANCE WELDING EQUIPMENT

All-State

CAN YOU MAKE AN ARC WELD ON CAST IRON THAT IS EASY TO MACHINE?

★

This new electrode makes it something that any operator can do.

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The special alloys in All-State No. 2 Machinable Cast Iron Electrode make its arc deposits the softest, most machinable cast iron that ever demonstrated a tensile strength of 55,000 lb. per sq. inch. All-State No. 2 is the right electrode to use for repairing such parts as gears and cylinder heads and blocks, or for doing general welding of cast iron.

It comes in standard 14-in. length, 3/32 in., 1/8 in., and 5/32-in. diameter, 50 lb. to the package.

For more information send for a free copy of our new catalog No. C-1 and price list. Order any amount you want. We'll ship it immediately and bill through our distributor for your area.

The All-State line includes a wide range of low-temperature welding and brazing alloys and fluxes.

ALL-STATE WELDING ALLOYS CO., Inc.
98 WEST POST ROAD • WHITE PLAINS, N. Y.

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A quicker way to join cast iron to steel!

...make smooth, sound joints

...reduce number of operations

...save minutes, money, material

If you have been using bolts or rivets to join cast iron to steel, consider the big advantages now offered by welding these two metals with NI-ROD*.

Originally developed to give you machinable welds in cast iron . . . for repair and maintenance work . . . this new, easy-handling electrode is now helping to eliminate many time-consuming operations in equipment production.

Whether you are welding cast iron to cast iron, or joining cast iron to steel, NI-ROD enables the welder to lay a smooth bead, non-porous and crack-free, on any part of a casting. The strong, sound, machinable welds it provides . . . generally without pre-heating . . . are important reasons why more and more manufacturers are turning to NI-ROD for production purposes.

Try NI-ROD Electrodes yourself. Order a 5-lb. package from your nearest INCO distributor. Available in 3/16", 5/32", 1/8" and 3/32" diameters. And, be sure to get your copy of the NI-ROD booklet.

*Reg. U. S. Pat. Off.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York 5, N. Y.

A BIG TIME SAVER ON PRODUCTION LINES

The National Rubber Machinery Company formerly mounted this switch box on steel supporting bars bolted to the cast iron base of the stock turret. The procedure required: (1) Chipping the casting face...at 4 places...until it conformed to the proper angle for fitting the bars against it. (2) Making a bracket. (3) Drilling and tapping bolt holes in the casting. Ni-Rod eliminated these operations...and made the application rapid, simple, easy.

Ordinary straight bars, held against the casting at the proper angle, are now welded on without further ado...saving considerable time and money. Moreover, by using Ni-Rod to build up the casting surface at spots where a top bar is to be welded, the manufacturer is able to square up both bars.

Welding procedure is simplicity itself. There is no preparation of the casting, nor is any pre-heating used. Each weld made in a single pass, using 5-32" Ni-Rod electrodes. Welds are peened with a hand hammer.

The welding operator on this job calls Ni-Rod, "the smoothest-running rod I ever used—easy to handle, and gives excellent fusion."

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Instant arc
A.C. WELDERS

the PRODUCTION MAN'S WELDER

Instant Arc Striking means faster, smoother production welding on light sheet metal because it is so easy to strike and hold the arc. On heavy jobs, the Automatic Voltage Control reduces spatter and assures the best arc. Welding is the shortcut to lower costs and faster production.

the MAINTANCE MAN'S WELDER

Marquette Instant Arc Welders are truck mounted for easy mobility. Just plug-in the Marquette Welder and you're ready to repair vital machinery quickly and inexpensively without dismantling. Maintenance men find hundreds of jobs they can do better and cheaper with welding, such as, building racks, bins, guards, trucks, etc.

the TOOL & DIE MAN'S WELDER

Broken or worn high speed tools, cutters, drills, punches and dies are quickly and inexpensively built up and hardsurfaced. Make new tools and dies from low carbon steel and hardsurface the working edges. Use versatile Marquette Welders for building jigs, fixtures gauges, etc.

A MODEL FOR EVERY NEED

Marquette's special transformer design gives you Instant Arc Striking without the use of high frequency or booster gadgets. Model 262C has built-in Capacitor for High Power Factor. New Telnic Bronze plugs and sockets double current carrying capacity on high heats. Generous use of aluminum increases transformer efficiency. Models: 262 and 262C (with capacitor), 20–275 amps.; 261 and 261C (with capacitor), 20–200 amps. Eight additional models 125 to 400 amps.

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sentatives from the Hawaiian Islands, France, England and Switzerland and of course, many from Canada.

About half of the Annual Meeting papers were published in the October and November issues. The remaining papers will be published as soon as possible in current issues of the JOURNAL or Supplement. Written discussions of any of these papers are invited.

Announcements concerning the awards of medals and prizes have been made in the December and January issues.

For the first time since the war, social functions were resumed including the President's Reception, Annual Dinner and Dance, Ladies' Entertainment and the like. There were an unusual number of Committee meetings.

Special thanks are due to the Ambassador Hotel for the many facilities offered in making the Convention a success.

BOUND VOLUME JOURNAL

The AMERICAN WELDING SOCIETY has made arrangements for members who wish to have their Journals for 1946 bound in attractive, imitation black leather covers, to do so by sending copies of the twelve issues to George W. Miller & Son, 176 Park Row, New York, N. Y. A special price has been arranged at $4.00 per volume providing the issues of the Journal are sent to the binder on or before Feb. 20, 1947. Journals received after this date cannot be bound at this price. The bill for the binding and return postage will be sent direct from the SOCIETY'S office.

WESTERN METAL CONGRESS

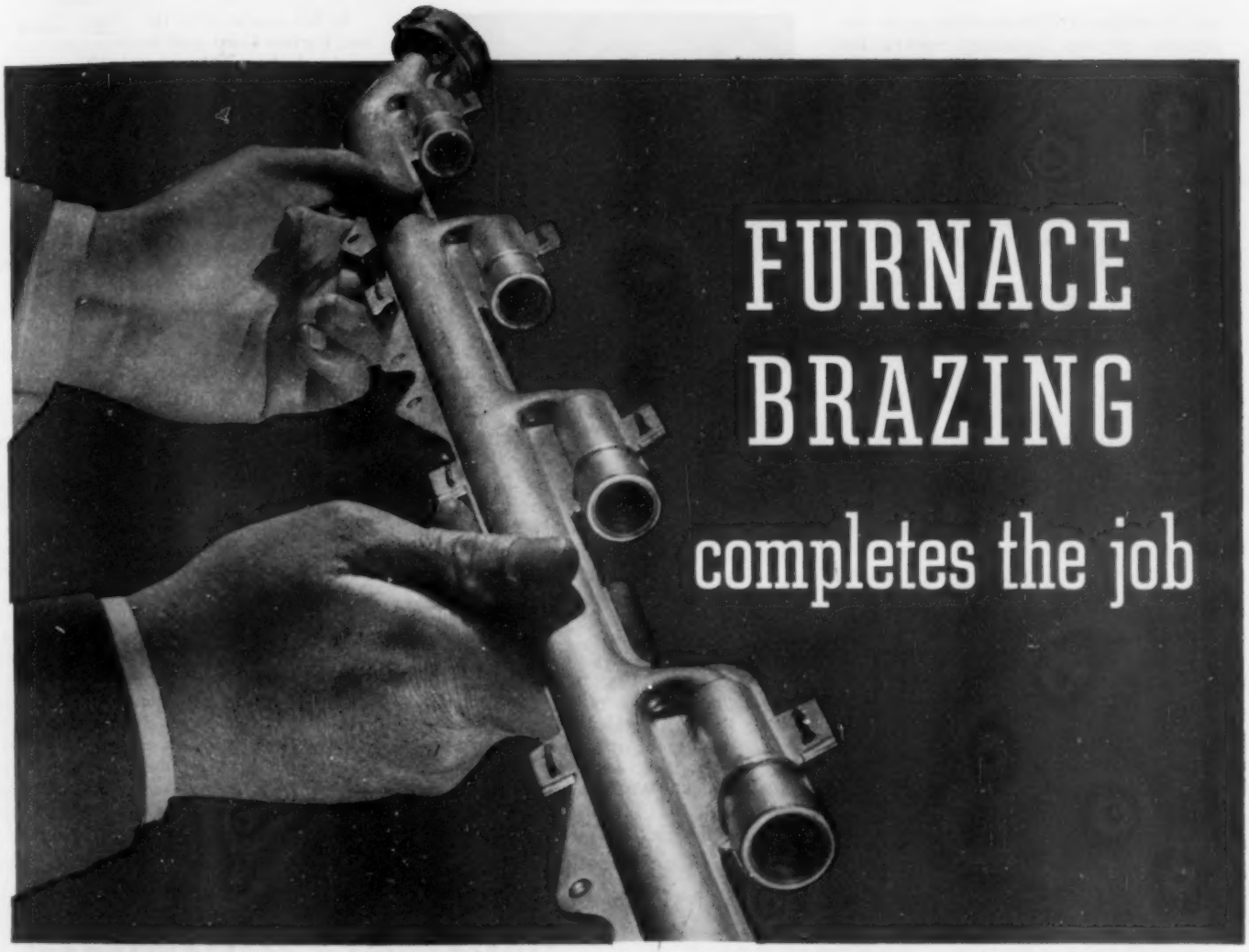
The best practical and technical program ever presented to the metal industry at a Western Metal Congress is taking shape according to Dr. John E. Dorn, Assoc. Prof. of Metallurgy, University of California, Berkeley, and chairman of the program committee of the Congress which will be held at Oakland Municipal Auditorium, March 22 to 27, 1947.

"Some of the most outstanding scientists and research investigators of the United States have accepted invitations to appear on the program," says Dr. Dorn. "The program will cover practically every phase of the manufacture, production, fabrication, inspection, testing, welding and use of metals."

Assisting Dr. Dorn in the work of the program committee are Prof. Cutler Shepard of Standford University and Fred Donlevy of the Caterpillar Tractor Co., San Leandro, vice-chairmen of the committee, together with representatives of the fifteen national technical and engineering societies having branches in the West that are cooperating in the Congress.

The Western Metal Exposition, which will be held simultaneously with the Western Metal Congress, has already received applications from more than one-hundred leading metal manufacturers of the East and West for the privilege of participating in the exposition, which will occupy over 100,000 sq. ft. of space.

This is the fifth Western Metal Congress



The two halves of this cable conduit are stamped out of Alcoa Aluminum Brazing Sheet. Placed face to face, the pipe couplings are added, and the assembly is held tightly together. Then into the furnace it goes, to be brazed into a solid unit . . . a quick, simple operation.

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ALCOA FIRST IN ALUMINUM

IN EVERY COMMERCIAL FORM

and Exposition held in the West under the auspices of the American Society for Metals

H. S. SMITH MADE HONORARY MEMBER

H. Sidney Smith, Consulting Engineer for Union Carbide and Carbon Corp., has been an outstanding figure in the welding and cutting industry in the United States and abroad for nearly 50 yr. He was one of the founders of the AMERICAN WELDING SOCIETY which he has served as a member of the Board of Directors, a member of the Executive Committee and a member of numerous technical and standing committees. He is also a past-president of the International Acetylene Assn., the British Acetylene Assn. and the Compressed Gas Manufacturers' Assn.

Mr. Smith has been awarded both the Samuel Wylie Miller Medal of the AMERICAN WELDING SOCIETY and the Morehead Medal of the International Acetylene Assn. and was the first person to receive these two outstanding awards of the welding industry.

Mr. Smith was born in Newark, England, and was educated at Nottingham University, where he studied electrical engineering. In 1896 he joined the Acetylene Illuminating Co., Ltd., which was experimenting with the manufacture of calcium carbide. He assisted in the preliminary experiments there, and in conjunction with S. G. Worth (the founder of the British Acetylene Assn.) produced

the first calcium carbide made in Great Britain on a commercial scale.

He became General Manager of the Acetylene Illuminating Co., Ltd., and also of the British Autogenous Welding Co., Ltd., and in 1910 he was elected President of the British Acetylene Assn. The next year he came to America and joined the Prest-O-Lite Co., Inc., in Indianapolis, Ind., becoming Works Manager in charge of all gas plants. In 1918 he became Consulting Engineer for Union Carbide Co.

In his career with the Union Carbide and Carbon Corp. and its associated companies, he has made many important contributions to the oxyacetylene industry, and has been the author of numerous technical articles on the uses of oxygen, acetylene, calcium carbide and oxyacetylene apparatus, one of the first instruction manuals on oxyacetylene welding and cutting being written by Mr. Smith.

On the subject of industrial safety and fire prevention he has worked actively with insurance and regulatory bodies in developing and applying rules and procedures to improve the safety standards of the industry. Mr. Smith's work has contributed greatly to the acceptance of the oxyacetylene and the compressed gas industries as being among the best regulated of American industries from the standpoints of safety and accident prevention.

Elected President of the International Acetylene Assn. in 1920 and President of the Compressed Gas Manufacturers' Assn. in 1928, Mr. Smith has also been for many years a director and a member of the Executive Committee of both the International Acetylene Assn. and the AMERICAN WELDING SOCIETY. He is a member of the American Society of Mechanical Engineers, the American Society for Testing Materials, the National Fire Prevention Association, the National Safety Council, the American Society of Safety Engineers and a number of other engineering groups. In practically all of these associations, Mr. Smith has served in important executive capacities.

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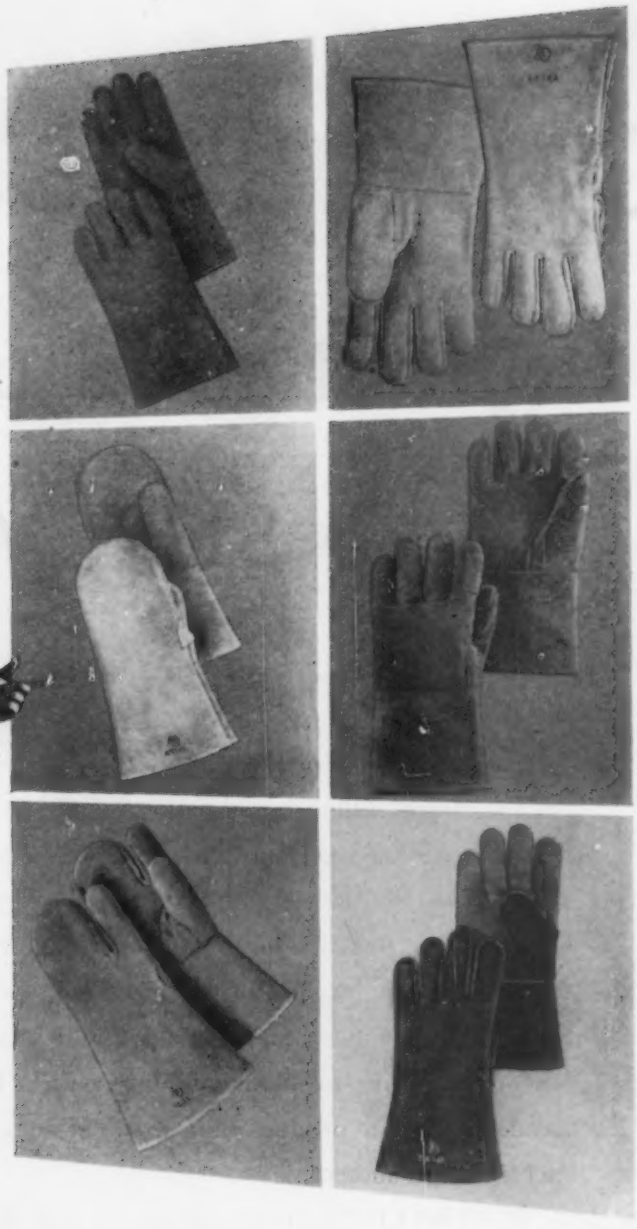

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Through its extensive field organization, A-O is in constant touch with changing conditions on the industrial fronts—is usually first with what welders want in completely comfortable, protective wear.

The complete line includes gloves and mittens for every special requirement, all types of safety goggles (including the new head rest type so popular with production welders), clothing, helmets, shields and respirators.

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ONLY *THOUSANDS*

of satisfied users could make SUREWELD a leader

For years SUREWELD Electrodes have been one of the largest selling brands in a crowded, highly competitive market. Could anyone ask for better proof of SUREWELD performance? What point can there be to academic discussions of electrode merits when the proof of *any* product is in its performance . . . and so many *thousands* of satisfied users have come to insist on SUREWELD Electrodes? Only a product of *unusual* merit could achieve such success.

SUREWELD Electrodes are the product of one of the *largest* and most modern electrode manufacturing plants in the world. The high-speed, high-precision equipment that makes them has no counterpart in the industry. It was designed and built by engineers of the Hollup Division of NCG and it makes electrode uniformity virtually inescapable. That is why, "Reliably uniform performance" is the most frequently stated reason for SUREWELD preference. Compare SUREWELD with *any* other electrodes and *see* the difference in performance.

For the utmost in welding satisfaction, you, too, will find it pays to insist on SUREWELD. Hundreds of authorized distributors are ready to serve you. And NCG welding experts are always at your call for able and unbiased consultation.

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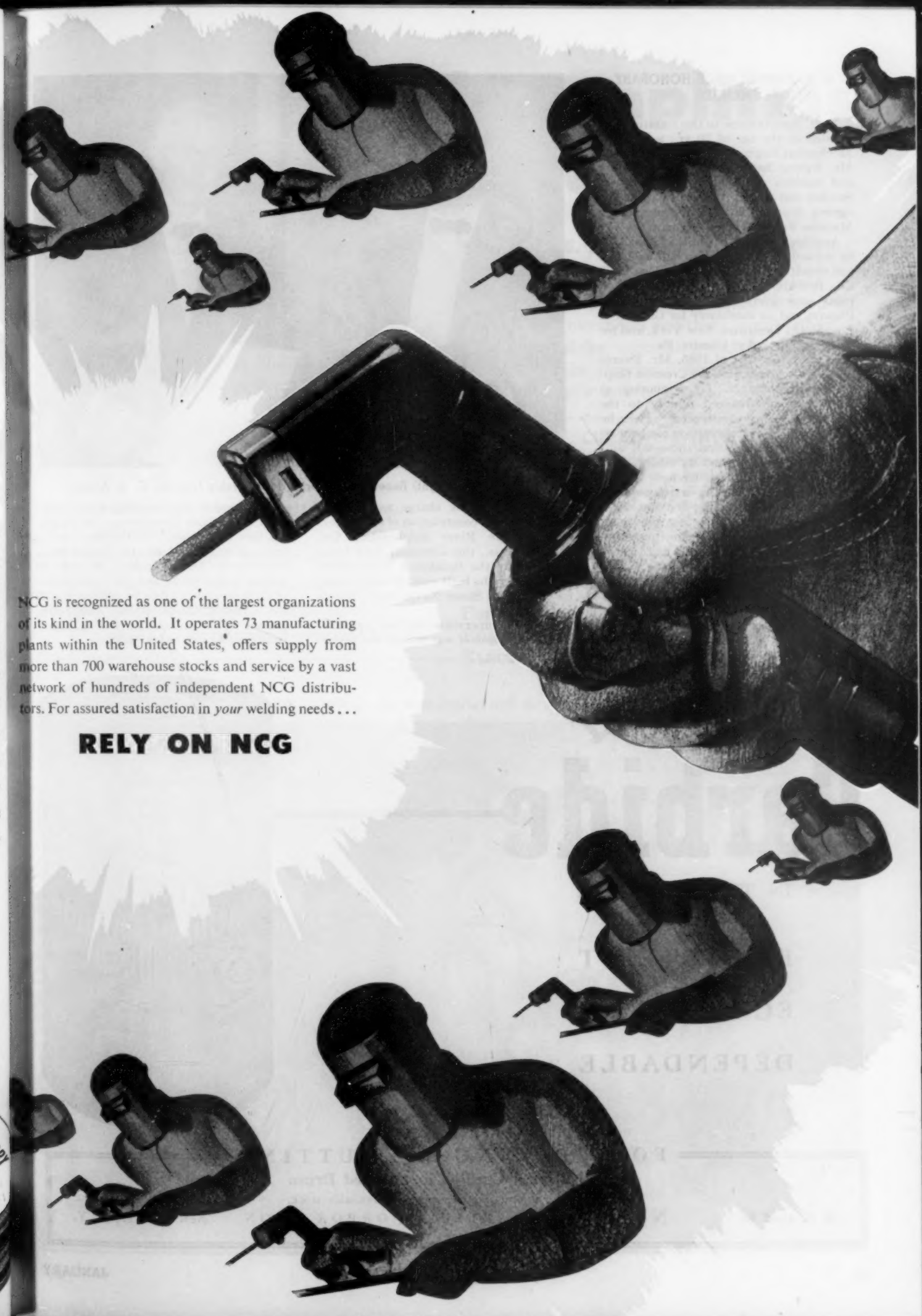

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RELY ON NCG

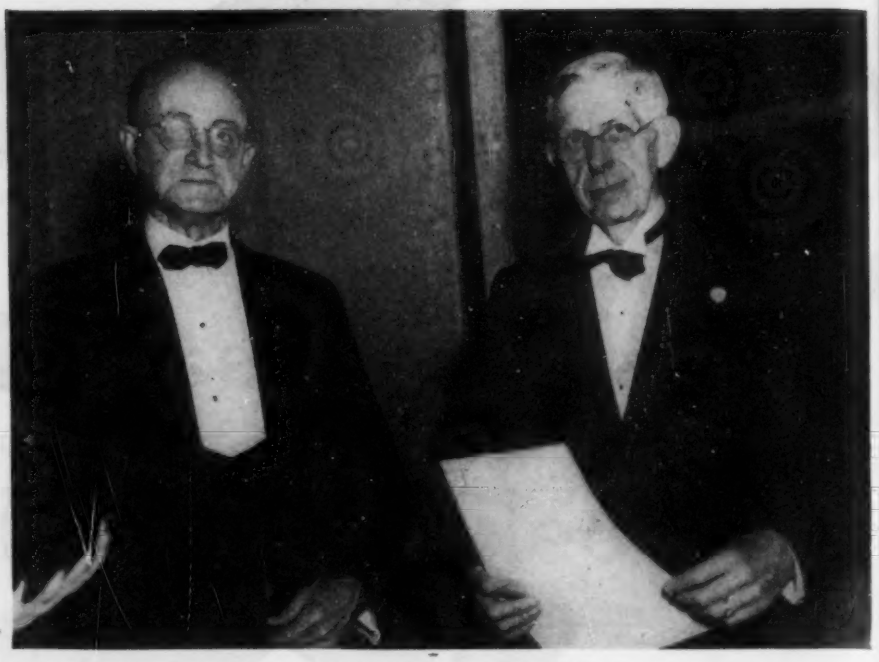
E. H. EWERTZ MADE HONORARY MEMBER

E. H. Ewertz came to this country from Sweden at the age of 20 yr., a graduate Mechanical Engineer. Prior to his coming Mr. Ewertz had worked in the foundry and machine shop of the Navy Yard in Sweden and also in the drafting and designing department of the Schwatzkoph Machine Fabrik, Berlin, Germany.

Arriving in New York in the fall of 1893 he worked for a year and a half as driller and shipfitter at the Erie Basin Dry Dock Co., Brooklyn, and later as draftsman on sugar machinery for Krajevsky and Phesant and on machinery for Gardner & Cox, Yacht Designers, New York, and for Roche's Shipyard at Chester, Pa.

In the latter part of 1895, Mr. Ewertz became associated with the Crescent Shipyard, Elizabeth, N. J. Beginning as draftsman he advanced rapidly to the position of Chief Constructor. Here he had charge of the construction of about 80 vessels including the first successful submarine, the *Holland*, and six others; also many types of naval and merchant vessels. Under his supervision the first pneumatic tools were tested out; the first smokeless powder machinery and testing guns were built; experiments with the one-man torpedo were carried out as well as the field guns for firing dynamite charges.

In 1903 Mr. Ewertz resigned to accept a position as General Manager of the Victor Metals Co., Weymouth, Mass. Here he specialized in high strength bronze and copper-nickled alloy castings.



E. H. Ewertz (Right) Receiving Honorary Membership from Dr. C. A. Adams

In 1905 he took charge as Assistant Manager of the construction of submarines at the Fore River Shipbuilding Co., Quincy, Mass., this Company later being absorbed by the Bethlehem Shipbuilding Corp. There he built some 80 submarines for the United States Navy, Spain, Russia and Chile.

Under his supervision the first organized mass production of war vessels was undertaken; and in 1914 completed a contract with the British Government for 20 submarines in 15 mos. In October 1917, a contract was signed with the United States Government for the building of a new 15 million dollar plant and the construction of 35 destroyers; all to be delivered in 27 mo. Taking charge of this undertaking proved to be a most interesting opportunity for service to his country.

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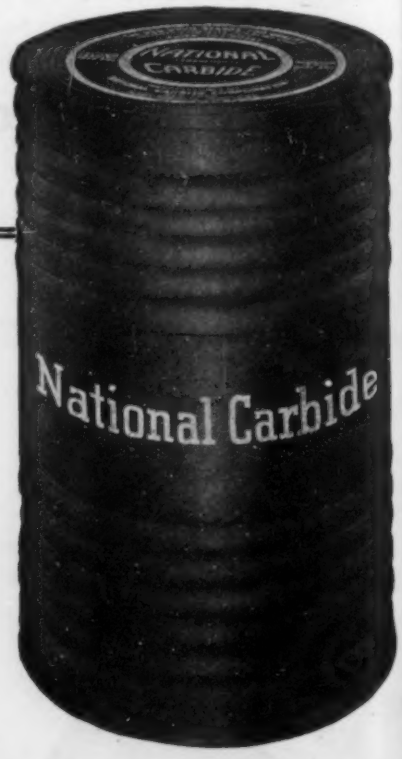

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New electrode simplifies tough-to-weld jobs

"SHIELD-ARC LH-70" is a new heavily coated electrode designed primarily for the welding of steels of poor weldability. Its as-welded properties are 75,000 to 80,000 lbs. per sq. inch and 25% to 30% elongation in 2". Stress relieved tensile strength is 70,000 lbs. per sq. in. minimum. Normally it produces a convex bead.

TYPICAL APPLICATIONS. Experience to date shows that this electrode produces exceptional results in these applications:

Low alloy high tensile steels which cannot be preheated.

High sulphur (free machining) steels.

High carbon, medium carbon steels.

High silicon electrical sheet steel.

For welds to be porcelain-enameled without annealing.

PROCEDURE. Use DC — electrode positive, work negative.

Hold a short arc. 1/8" and 5/32" may be used for vertical and overhead positions, single or multiple pass. Make vertical welds from bottom upward. Make overhead welds with stringer beads or narrow lateral weave.

CURRENT RANGE	
Rod Size	**Amperes**
1/8"	100—135
5/32"	140—190
3/16"	180—250

For further details, call the Lincoln Welding Engineer nearby or write THE LINCOLN ELECTRIC Co., Dept. 121, Cleveland 1, Ohio.

Butt welding medium carbon (.50% C) steel sprocket teeth forgings with the new Lincoln "Shield-Arc LH-70" Electrode.

After the war in December 1918, Mr. Ewertz became General Manager of the Moore Plant of the Bethlehem Shipbuilding Corp., Elizabeth, N. J. Here in addition to ship construction, Mr. Ewertz produced machinery for oil refineries, ship deck machinery, all types of pumps, steam turbines, Diesel engines, oil burning equipment and general machine and foundry work.

In 1928, Mr. Ewertz resigned to establish his consulting welding engineering practice in New York City in order to further promote and properly develop the vast possibilities of fusion welding in ship construction, steel structures, storage tanks, and to render assistance in redesigning and surveying.

Mr. Ewertz has been consulting engineer for the Electric Boat Co., Groton, Conn., since 1934. In that capacity he went to Manitowoc, Wis., in 1941 to assume charge of the construction of submarines built to the specifications of his company and under its supervision at the Manitowoc Shipbuilding Co.'s yard for the United States Government, the first submarines ever to be constructed inland. Built there, about 1000 miles from the sea, to utilize the capacity of the shipyard, the submarines had to be conveyed in floating drydocks down the Mississippi River to New Orleans, from where they proceeded under their own power to Groton, Conn., for tests and trial runs.

Mr. Ewertz has been a member of the AMERICAN WELDING SOCIETY since 1921, serving as Chairman of the New York Section from 1922 to 1924. He was elected President of the SOCIETY for the year 1924–25 and since then has been active in the SOCIETY as a Director, chairman or a member of many committees on welding codes, chairman of the Educational Committee and chairman of the Code on Principles of Conduct. He was awarded the Samuel Wylie Miller Memorial Medal in 1930, an honor conferred by the SOCIETY for outstanding contributions to the advancement to the art of welding.

Among the many activities in which Mr. Ewertz has participated or is at present engaged are: Member, Society of Naval Architects and Marine Engineers; Associate Member of the Naval Engineers Society; President, Y.M.C.A., Elizabeth, N. J.; Member and past Vice-President, Elizabeth Chamber of Commerce, and Member and former Director, New York Board of Trade.

WINNER SECOND PRIZE A. F. DAVIS UNDERGRADUATE AWARD
L. M. RAGSDALE

"Welded Homes for Millions" won the second prize of the A. F. Davis Undergraduate Award administered by the Educational Committee of the AMERICAN WELDING SOCIETY. Other winners were reported in the December issue of the JOURNAL.

Mr. Ragsdale was born in Knoxville, Tenn., March 7, 1926. He attended the Knoxville public schools, graduated from Knoxville High School where he was an officer in the ROTC, a member of the National Honor Society, a member of the Hi-Y, Captain in the Victory Corps and editor of the school paper "The Blue and White." Mr. Ragsdale was also interested in Boy Scout work and model airplane construction.

L. M. Ragsdale

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Transformers of all types.
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Same analysis as shielded arc electrode. Useful for railroad track work and applications where appearance of weld metal deposit is relatively unimportant.

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After graduating from High School in June 1943, Mr. Ragsdale entered the University of Tennessee, enrolling in chemical engineering. While at Tennessee, he was a member of Phi Gamma Delta social fraternity, and Phi Eta Sigma, honorary scholastic fraternity. He left the University of Tennessee after four quarters to enter the Navy V-12 College Training Program at Duke University, Durham, N. C. At Duke he was a member of the Engineers' Club, on the staff of the DukEngineer, and was a member of the Knights of St. Patrick, honorary engineering society. In addition, he served as president of the student chapter of the Am. Soc. C.E. Upon graduation in civil engineering, he was released to inactive duty by the Navy, and now holds a reserve commission in the Civil Engineer Corps.

At present Mr. Ragsdale is employed by the Federal Housing Administration as a valuation aide in Knoxville.

BOARD OF DIRECTORS MEETING

The meeting of the Board of Directors of the AMERICAN WELDING SOCIETY, held on Thursday, October 24, 1946, in the Board Room, A.S.M.E. Engineering Societies Bldg., New York, N. Y., was called to order by President Hess at 9:40 A.M., with the following present:

Members: D. Arnott, R. W. Clark, F. W. Davis, J. H. Deppeler, O. B. J. Fraser, H. O. Hill, C. H. Jennings, A. B. Kinzel, H. W. Pierce, H. M. Priest, G. N. Sieger, R. D. Thomas and B. L. Wise.

By Invitation: E. V. David, Chairman, Convention Committee, and J. B. Tinnon, Chairman, Manufacturers Committee.

Staff Members: M. M. Kelly, Secretary; W. Spraragen, Editor; L. M. Dalcher, Technical Secretary and H. O. Klinke, Associate Secretary.

Resolutions in Memoriam

By a rising vote, a tribute to the memory of H. M. Hobart, in the form of Resolutions, was unanimously adopted. The Resolutions, were prepared by a Committee appointed by the President and composed of Dr. C. A. Adams, Chairman, F. M. Farmer and W. Spraragen.

Finances

(*a*) *Report on Year's Operations.*—Comments of the Treasurer on auditor's statement, showing the financial status of the SOCIETY at the close of the fiscal year ending September 30, 1946, were read by the Treasurer. Copies of the Treasurer's comments and financial statement were distributed at the meeting. The Treasurer called attention to the warning note in the auditor's letter, accompanying statements on the year's financial operations. He stated while there is no cause for alarm at this time, the trend can be reversed and it is believed, therefore, desirable to effect economies wherever possible. Serious thought will be given this matter in the preparation of the budget for the new fiscal year.

After deliberation, the Board voted to accept, with thanks, the Treasurer's report on financial operations of the SOCIETY for the fiscal year ending September 30, 1946.

(*b*) *Remission of Dues.*—Thought was given to the present manner of handling arrearages of long standing. It was deemed advisable in future to adhere to the Board ruling and By-Law in respect to nonpayment of dues, that is, to supply THE WELDING JOURNAL and other literature for the first two months of delinquency and to drop from the rolls any member whose dues remain unpaid after a period of several months, such member having received due notification directed to the latest post office address as it appears on SOCIETY records.

Further, that any such member can be reinstated at any time upon request and payment of a year's dues, excepting where a member wishes continuity of membership, in which case he shall be required to meet dues payment during period of delinquency.

(*c*) *Engineering Societies Library.*—Consideration was given communication from the Secretary of United Engineering Trustees, seeking assistance of A.W.S. in the enlargement of the work of the Engineering Societies Library. Because of the Library's usefulness to A.W.S. staff members for reference purposes, it was felt that a contribution of the order of other associate societies was in order.

On recommendation of the Finance Committee members, who were polled at this meeting, a contribution of $200 to the Engineering Societies Library was authorized.

(*d*) *Awards Sponsored by A.W.S.*—Consideration was asked of desirability of continuing practice of meeting incidental expenses incurred in connection with the handling of these awards, which averaged per year several hundred dollars for preparation, postage and mailings of announcements and releases and for furnishing complimentary tickets to affairs where presentation takes place.

The Board authorized the continuance of this practice.

(*e*) *Welding Research Council.*—Reference was made to communication received from the Director of W.R.C. concerning a contribution to the work of W.R.C. He pointed out that up to the present year, A.W.S. has been shown in the Council budget as a contributor "in kind." This year W.R.C. decided to eliminate such contributors from its budget. In view of the fact that the founder societies, some of whom have recently been admitted to sponsorship, each are contributing $250, it was suggested that A.W.S. make a similar contribution so that its name will appear on contributor list.

On recommendation of the Finance Committee, whose members were polled at this meeting, a contribution of $250 to the activities of W.R.C. was authorized.

(*f*) *Enlargement of Bond Coverage of A.W.S. Officers and Employees.*—Proposal for this enlargement was covered in memorandum distributed at Board meeting and attached to minutes of absent members.

After due consideration, and on recommendation of members of the Finance Committee, the Board voted to broaden present coverage of an $11,000 Schedule Bond for three positions (Treasurer, Secretary and bookkeeper) at an annual cost of $25, to a $10,000 Blanket Position Bond for all salaried and nonsalaried officers authorized to sign checks, as well as all paid employees of the Society, at a cost of $375 for a three-year period or an annual average cost of $125.

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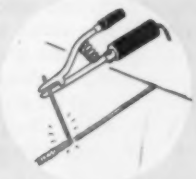

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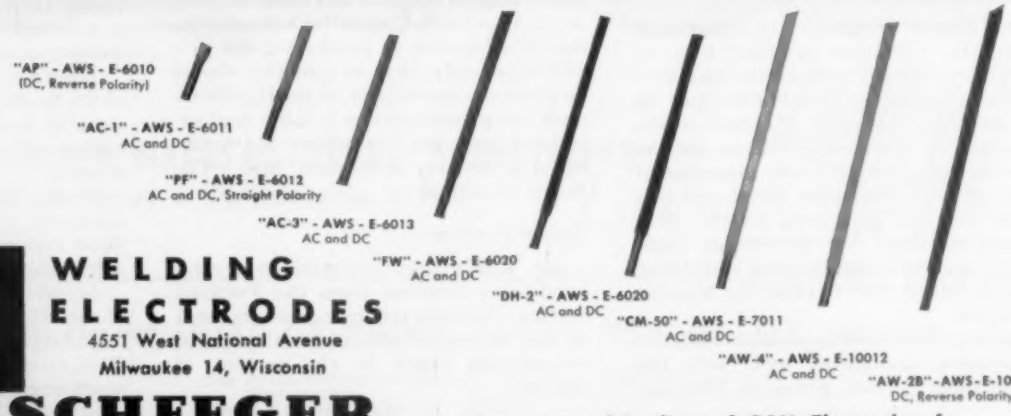
"AP" - AWS - E-6010
(DC, Reverse Polarity)
"AC-1" - AWS - E-6011
AC and DC
"PF" - AWS - E-6012
AC and DC, Straight Polarity
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AC and DC
"FW" - AWS - E-6020
AC and DC
"DH-2" - AWS - E-6020
AC and DC
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Technical Activities Committee Recommendations

Recommendations presented by the Chairman of T.A.C. and actions taken thereon by the Board are recorded below:

Tentative Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Electrodes.—Upon recommendation of T.A.C., the Board voted the approval of Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Welding Electrodes for publication as a tentative standard of the SOCIETY.

Discharge of Committee on Large Welded Pipe for Hydraulic Purposes.—The T.A.C. Chairman reported that this Committee has been inactive since 1941. He stated after a thorough investigation, conclusion was reached that continuance of the Committee does not seem desirable. This conclusion was based on facts: (1) wide geographical distances separating those qualified to serve on a specialized Committee of that kind makes it difficult to accomplish very much of value; (2) A.S.M.E Boiler Code and A.S.M.E.-A.P.I. Code are being presently used by those engaged in pen stock construction; (3) there does not appear to be a sufficiently broad interest in the subject to warrant the reorganization of the Committee.

Upon recommendation of T.A.C., the Board voted the discharge of the Committee.

Representation on A.S.A. Sectional Committee Z-10.—In view of report received from the A.W.S. representative on this committee, that the discussions of the committee these past several years have not touched on welding, Mr. Pierce stated that T.A.C. felt it is inadvisable to continue representation.

On recommendation of T.A.C., the Board voted the withdrawal of A.W.S. representative on A.S.A. Sectional Committee Z-10.

Progress Reports on 1946 and 1947 Annual Meetings of A.W.S.

1946 Annual Meeting.—The Convention Committee Chairman reported that on September 15th and 16th, certain members of the Convention Committee met in Atlantic City with the Manager of the Atlantic City Convention Bureau, and the Convention Manager and department heads of the Ambassador Hotel, and discussed matters pertaining to the 1946 Annual Meeting. The Convention Committee received assurance that everything possible will be done to make our meeting a success.

On the afternoon of September 16th, the Convention Committee met with the Philadelphia Section group in Philadelphia and reported on its findings in Atlantic City. The local committees in turn rendered progress reports on their various assignments.

A further conference of Convention Committee officers with the Philadelphia group was held on October 21st.

As a result of the October 21st discussion, it appears that everything will be in readiness for the opening of the 1946 Annual Meeting.

1947 Annual Meeting.—The Convention Chairman reported that, acting on vote of the Board of Directors authorizing acceptance of A.S.M. invitation to participate in the 1947 National Metal Congress and Exposition to be held in Chicago the week of October 20th, subject to approval of Convention and Manufacturers Committees, and the obtaining of suitable hotel headquarters, a poll was taken by the Chairman of the Manufacturers and Convention Committees. The Chairman of these two Committees reported back approval by their Committees of A.W.S. participating in the 1947 National Metal Congress and Exposition.

With this approval in hand, representatives of the National Convention and Program Committees, and members of the Chicago Section, met in Chicago on September 27th and inspected hotel facilities in that City for housing the 1947 Annual Meeting.

As a result of this study, the officers of the Convention and Program Committees and the Chicago Section officers who inspected the facilities, voted to house the A.W.S. Convention in the Sherman Hotel and plans are proceeding along that line.

The Board expressed its gratitude to the Convention Committee Chairman for his thoroughness in handling these matters.

Progress Report on Welding Handbook

Editor Klinke made reference to points covered in his report dated October 11, 1946, which was distributed at the meeting. He outlined procedure followed in the preparation of chapters and made mention of the Handbook Committee's recommendation in respect to publicizing the new edition, namely, that no publicity should be given the new edition of the Handbook until the present edition is fairly well exhausted, and the Committee has established a definite publication date. The Board concurred.

Section Activities

Mr. Klinke drew attention to a communication received from the Portland Section Chairman requesting disbandment of that Section because of inactivity, and transmitting check in the amount of $326.84.

It was the opinion of the Board that since the Boston Section has expressed its willingness to have the Portland members affiliated with their Section and to aid in advancing welding interests toward the end of maintaining a Section in a center convenient to the majority of members in Portland, Bath and surrounding towns, it is to the best interest of all concerned to turn over to the Boston Section money returned by the Portland Section.

Accordingly, the Board voted that the sum of $326.84 be forwarded to the Boston Section, in the expectation that this money will be spent in the interest of members in the Portland area. Mr. Davis agreed to transmit the Board's thoughts in this regard to officers of the Boston and Portland Sections.

Independent Welding Exhibit

At the start, the President reminded those present that the purpose of the discussion of this subject is to determine the feasibility and desirability of the SOCIETY affiliating itself with a movement of this kind, whether for profit or otherwise. He asked that the subject be discussed tranquilly. He explained that Mr. Tinnon was present to report the manufacturer's viewpoint because of his holding the dual position of Chairman of A.W.S. Manufacturers' Committee and of a similar committee of N.E.M.A.

The "pros" and "cons" of an undertaking of that kind were discussed at great length. Some of the pertinent points brought forth by the opponents and supporters of the movement are cited below:

Opponents.—Duplication of shows of a similar nature is not warranted. Tendency has been and is likely to be even greater in the next few years, to cut down on the number of industrial exhibitions because of increased costs and the mean hours spent on such activities.

National Metal Exposition attendance represents the largest users of welding and buyers of welding equipment and supplies, rather than competing welding interests as is likely to be the case in an independent welding exhibit.

Tendency has been to raise the standard of the SOCIETY to that of a strictly professional or technical society. A show undertaking will more or less commercialize the SOCIETY.

Efforts should be made to improve SOCIETY's position the National Metal Show rather than take on burden of an independent venture.

Supporters.—Interest in the fabrication of metals by the welding processes is of itself large enough to warrant a separate show, rather than an adjunct to some very much larger activity.

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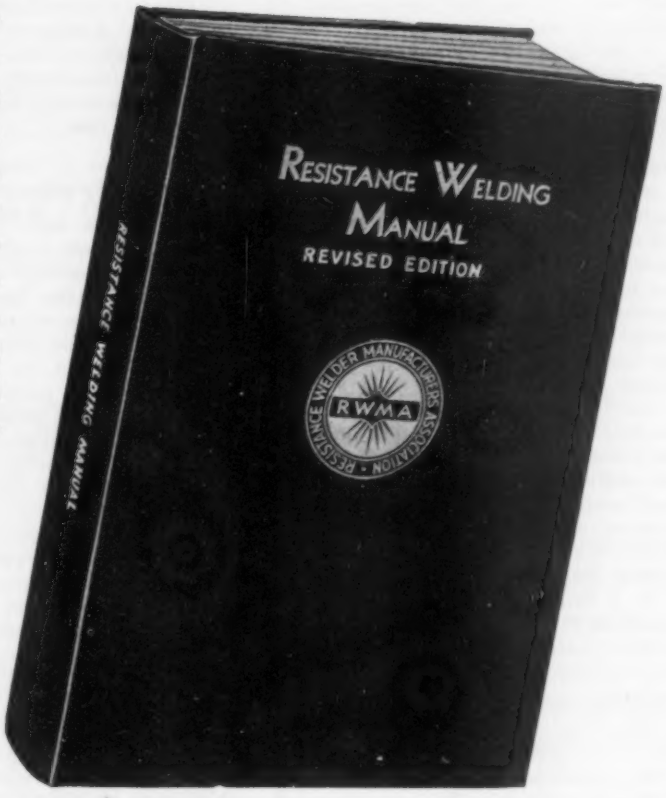
RESISTANCE WELDING MANUAL

(REVISED EDITION)

Complete • • • Comprehensive • • • Authoritative

THIS newly published manual is the most complete treatise on resistance welding ever published. It explains in great detail what resistance welding is, what it does and how to get most satisfactory results from this process. The results of important research studies are briefed, collated and arranged for easy reference. Leading authorities in industry have contributed up-to-date information on practices and procedures. Every phase of the subject has been included which could possibly make this manual useful to engineers, production executives and machine operators. If you use resistance welding in your plant, you need this book.



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CONTENTS

Fundamentals — Applications — Economics — Design — Process Control — Spot, Seam, Flash, Projection Welding — Electro-Brazing — Electro-Forging — Pulsation Welding — Percussive Welding — Low Carbon Steel — Hardenable Steels — Stainless Steel — Coated Steels — Aluminum, Copper, Magnesium and Nickel Alloys — Die Castings — Lead — Dissimilar Metals — Electrodes, Wheels and Dies — Recommended Practices — A.C. Machines — Jigs and Fixtures — Controls — Electrical Characteristics — Stored Energy Systems — Power Supply — Instrumentation — Standard Tests and Quality Control — Maintenance — Definitions — Symbols — Tables.

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An independent welding exhibit can be held in cities not large enough to accommodate the Metal Show. The present hotel housing situation will be remedied.

Independent exhibition, to include fabricators of metals by all welding processes, and other allied interests, will produce a worth-while audience, and if properly financed, managed and operated by a competent, experienced exhibition organization, will produce revenue for A.W.S. that will enable the SOCIETY to expand its activities in desired directions, render greater financial assistance to its Sections, and build up a reserve that can weather the storm in periods of depression.

It was generally agreed that without facts and figures to substantiate the evidence shown of the desirability of the SOCIETY undertaking the sponsorship of an independent welding show, it is not possible for the Directors to take action.

It was further agreed that the SOCIETY ought not to entertain any proposal which will not better its present arrangement for participation in the Metal Show, and it was further agreed that the tax and legal aspects of sponsoring a welding exhibit should be thoroughly investigated before the SOCIETY embarks on such an undertaking.

The deliberations resulted in the adoption by the Board of a motion to authorize the President to appoint a small committee, with purpose to investigate and report back possible arrangements for holding a separate welding exhibit sponsored by A.W.S.

Note! Messrs. H. W. Pierce (Chairman) O. B. J. Fraser and W. W. Reddie were named by President Hess for membership on this Committee with the understanding the Committee can be expanded if found necessary.

Election to Honorary Membership

On recommendation of the Committee on Honorary Membership and Honorary Directorship, H. Sidney Smith and E. H. Ewertz were elected Honorary Members of the SOCIETY. Citation for certificate submitted by the Honorary Membership Committee, indicated that H. Sidney Smith was selected because of his leadership in the development of oxyacetylene welding and cutting and his contribution to the improvement of safety standards and accident prevention in the welding industry; Mr. Ewertz for being a pioneer in the development and application of arc welding, and for his faithful and effective service to the SOCIETY in its early stages.

Constitutional Amendment

The By-Law Committee Chairman stated that the Committee's attention had been drawn to a conflict between the SOCIETY'S Constitution and its By-Laws regarding membership eligibility. The former provides for individuals, scientific societies, associations and governmental departments, and the latter, individual membership only. This Committee offered two proposals for remedying the situation; (1) to amend Article III of the Constitution by the elimination of "scientific societies, associations and governmental departments," and to add another paragraph providing for these organizations through individual representation; (2) to add a paragraph to Article I, Section 2, of the By-Laws to provide for institutional members.

Since the SOCIETY is an individual membership corporation and since at present scientific societies, organizations and governmental departments hold membership through individual representation, it was, upon due consideration, voted to amend Article III, "Membership" of the Constitution, so that it reads:

"Individuals having the qualifications set forth in the By-Laws of the AMERICAN WELDING SOCIETY are eligible for membership in the AMERICAN WELDING SOCIETY."

And, further, it was voted to submit this proposed amendment of the Constitution to the membership for adoption at some convenient time.

Postponement of Presentation of Samuel Wylie Miller Memorial and Lincoln Gold Medals

The President reported that the regulations governing these awards require that presentation take place at the Annual Meeting of the SOCIETY. Since neither recipient can be present at this year's Annual Meeting, he recommended that presentation be postponed until a more appropriate time presents itself. In the case of the Lincoln Medalist, he mentioned that the Western Metal Congress might be a suitable time, since he is located in San Francisco.

The Board concurred and accordingly authorized that announcement of the winners of these medals be made at the Annual Meeting and that presentation take place at the first suitable opportunity.

United Nations Educational, Scientific and Cultural Organization

The Board directed that the Secretary inform the N.R.C. that our SOCIETY favors cooperation with UNESCO and is willing to exchange publications and information along the lines of what it is doing at present with some of these nations.

Resolution of Appreciation

A rising vote in appreciation of services rendered by President Hess was taken and the Resolutions were adopted.

GRUMAN PROMOTED TO RegO SALES

Richard D. Gruman has been promoted to the RegO sales department of The Bastian-Blessing Co., Chicago, announced R. E. Poethig, sales manager of the RegO division. Since his discharge from the armed forces, Mr. Gruman has had several months' experience in the company's inspection department and several in expediting.

A graduate of North Park College, he did office and sales work for Peabody Coal Co. and Griswold, Walker, Bateman Warehouse Co. before joining the USAAF. After attending the AAF's Technical Inspection School at Lowry Field in Denver, he was a technical inspector for two years and an aircraft engineering officer for two

Richard D. Gruman

years, and instructed groups of English and Chinese cadets on P-38's and B-29's. Mr. Gruman, a Captain at the time of his discharge, is now in the Officers Reserve Corps, and is a member of the AMERICAN WELDING SOCIETY. He is married and the father of two small daughters.

KAUFMAN TRANSFERRED

Mr. Fred A. Kaufman, formerly Industrial Fellow on The McKay Company Fellowship at The Mellon Institute of Industrial Research, has been transferred to The McKay Co. as Metallurgical Engineer. Mr. Kaufman will be in charge of technical and engineering service in the Arc Welding Electrode Division of The McKay Co., Pittsburgh, Pa. He is a member of the AMERICAN WELDING SOCIETY.

DENNIS PROMOTED

Appointment of Harry A. Dennis as assistant district manager of sales in the Chicago office of Lukens Steel Co. and subsidiaries, By-Products Steel Corp. and Lukenweld, Inc., Coatesville, Pa., was announced today by J. Frederic Wiese, vice-president in charge of sales for Lukens and subsidiaries. Mr. Dennis had been sales representative for Lukens and its subsidiaries, in Erie, Pa., and vicinity.

He has been associated with Lukens Steel Co. since 1939, starting as a helper in the Open Hearth. Later, he was a welding research engineer on clad steels, alloy steels and manual and automatic welding processes.

For several years, he had been engaged in welding service engineering work as a member of the Technical Sales Service of Lukens and its subsidiaries.

Mr. Dennis is a graduate of Pennsylvania State College with the degree of Bachelor of Science in Metallurgy. He is a member of the American Society for Metals and of the AMERICAN WELDING SOCIETY.

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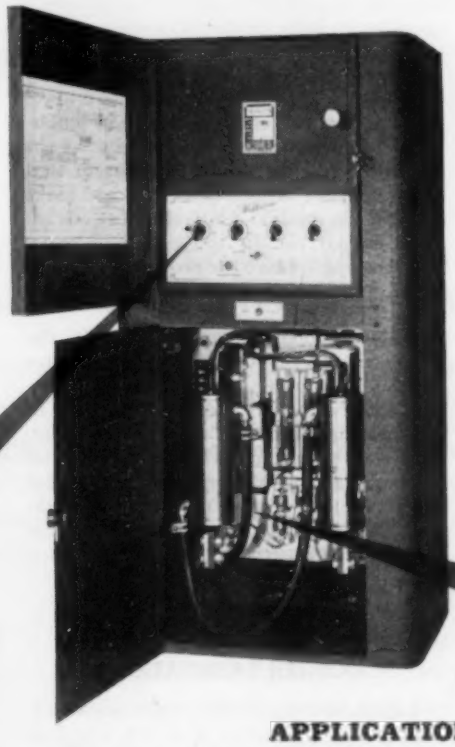

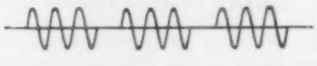

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CALLNER PROMOTED

Bent Laune, President, All-State Welding Alloys Co., Inc., 96 West Post Road, White Plains, N. Y., announced today that he had appointed S. S. Callner, of Chicago, Midwest Regional Sales Manager for All-State's line of low-temperature welding and brazing alloys and fluxes. The Midwest territory includes Illinois, Indiana, Wisconsin and the upper peninsula of Michigan. Mr. Callner is a member of the Board of Directors of the Chicago Section of the AMERICAN WELDING SOCIETY and is also affiliated with the Association of Iron and Steel Engineers, the Electric Association, and the Fusioneers. He graduated from the University of Illinois, and has had many years of experience in metallurgical and sales engineering, involving heat-treating equipment, mechanical and electrical maintenance equipment, and special welding alloys.

NEW EDITION OF WELDING TECHNIQUE ISSUED

A revised edition of "Ampco-Trode Welding Technique," known as Bulletin W-2A, has just been issued by Ampco Metal, Inc., Milwaukee 4, Wis. The new edition features the welding of aluminum bronze electrodes by the carbon and metallic arc methods. The new bulletin contains a comprehensive weldability chart for copper-base alloys, listing 33 bronze alloys, their chemical composition, physical properties and detailed weldability data.

"Ampco-Trode Welding Technique" is illustrated by 22 photographs, sketches and diagrams and contains tables of recommended currents and voltages. Copies will be sent on request.

HEAT TREATMENT OF ALUMINUM ALLOYS

While aluminum alloys have risen to the ranks of our most important metals, little information on heat treating them has been available. To meet this need, Reynolds Metals Co. has prepared an unusual treatment of the subject in its new process manual, "Heat Treating Aluminum Alloys." The purpose of this book is to provide information in a form readily usable by both the nontechnical man and the highly trained technician.

To attain this end, the first section of the book breaks down the subject into easily understandable concepts which the nontechnical reader can follow and so obtain a basic understanding of the metallurgy and heat treatment of the aluminum alloys. This simplified explanation of the what, why and how of heat-treating aluminum is said to be the first attempt ever made to bring this highly complicated subject down to a level where it can be easily understood.

Section Two then presents in brief tabular form the recommended thermal treatments for the various aluminum alloys.

Section Three is for the metallurgist and operating personnel. There will be found a more technical discussion of the various thermal treatments as well as detailed information on possible difficulties and suggestions for their cure. Also abnormal as well as normal metallographic structures are illustrated by an extended series of excellent photomicrographs that will be found very helpful by the metallographer in controlling quality of the heat-treated material.

This handy wire-bound 6- x 9-in. book was written by O. L. Mitchell and G. W. Birdsall of Reynolds Metals. It contains 144 pages, 81 illustrations, 13 tables, 18 photomicrographs and 2 charts. The books are available from Reynolds Metals Co., Dept. 47, 2500 S. Third St., Louisville 1, Ky., at the nominal price of $1 each

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GALVANIZING HANDBOOK

By John R. Daesen, Consulting Metallurgical Engineer, Chicago, Ill. Published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. Price $5.25.

In recent years methods of applying zinc (and tin) by electrodeposition, using precise control such as galvanizing has seldom enjoyed, have become increasingly popular in spite of the very great capital cost involved. Often the advantage of the new method has depended on its ability to yield a satisfactory product with a lower actual weight of coating, due to irregularity of distribution or other defects in the hot dip coat. It should be apparent that the avoidance of such defects should make the hot dip method relatively more advantageous, particularly in the case of heavy zinc coatings, where the protection is sacrificial, and the heavier the coat the longer the protection.

This handbook presents graphically the basic principles involved and demonstrates with photographic examples the nature and cause of many defects encountered in a consulting practice in a varied field. Many of the examples chosen were articles deliberately spoiled to indicate in an extreme manner, conditions which are difficult to illustrate in the degree usually encountered in practice.

COR-TEN FABRICATION

Complete data on the properties, fabrication and application of U.S.S. Cor-Ten are presented in the 68-page, $8^1/_2$ x 11 in., liberally illustrated, two-color booklet "U.S.S. Cor-Ten," just published by United States Steel Corp. Subsidiaries.

The first section of the new booklet discusses the various properties of this well-known high tensile strength steel, including its high resistance to atmospheric corrosion, and outlines how they may be utilized to best advantage. In the second section full data are given regarding fabrication by standard practices, including five pages on welding. The second half of the new booklet deals with the applications of U.S.S. Cor-Ten in various fields such as railroad passenger and freight equipment of all classes, trucks trailers and buses, mine cars, materials handling equipment and marine applications, and outlines still other possibilities of interest to all who are confronted with the problem of reducing weight in mobile equipment subject to atmospheric corrosion.

Test data, lists of equipment and users, together with photographs and charts, are liberally used to illustrate and substantiate the claims made for the various properties and applications of U.S.S. Cor-Ten.

Copies of this new booklet may be secured from any office of American Steel & Wire Co., Carnegie-Illinois Steel Corp., Columbia Steel Co., National Tube Co., Tennessee Coal, Iron and Railroad Co., United States Steel Export Co., or United States Steel Supply Co.

METALLIZING HANDBOOK

The latest and most complete collection of technical and operating data on the Metallizing Process is contained in the fourth edition of the *METCO Metallizing Handbook*, published by Metallizing Engineering Co., Inc., Long Island City 1, N. Y.

In addition to up to the minute data on preparation of surfaces, metallizing technique and finishing procedure, complete data on corrosion resistance, specific gravity, hardness, bond strength, tensile strength and relative shrink are contained in many interesting chapters.

Profusely illustrated with pictures, drawings, diagrams, charts and graphs, this 86-page pocket-size handbook presents both practical and technical aspects of the Metallizing Process in complete detail. The Handbook was published in October 1945 and is Priced at $2.

ARC WELDING AT LOWER BASE METAL TEMPERATURES

"Arc Welding at Lower Base Metal Temperatures" is the title of a new 4-page pamphlet just issued by the Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y., to announce their new development in metal arc electrodes—"Low-Temp" EutecTrodes.

This attractively illustrated booklet gives essential information on the development, advantages, applications, and data on revolutionary flux-coated rods for arc welding all types of metals. These electrodes because of their flux-coatings can be applied at lower base metal temperatures than are ordinarily required.

This attractively illustrated booklet also shows typical applications of these "Low-Temp" EutecTrodes for a variety of welding jobs from delicate low-heat work to heavy castings These alloys were designed to offer to the welding industry a complete line of free-flowing, fast melting, strong-bonding electrodes for welding every commercially used metal. Each type can be applied at *lower* base metal temperatures, thus reducing greatly the ill effects of the higher heats usually necessary in arc welding.

"LowTemp" EutecTrodes are available for tough welding problems on all types of metals, such as cast iron, stainless steel,

Announcing a new Electronic WELDER CONTACTOR

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INDUSTRIAL CONTROLLER DIVISION
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- Generous wiring space.
- Removable steel base plate.
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- Flat door for close ganging.
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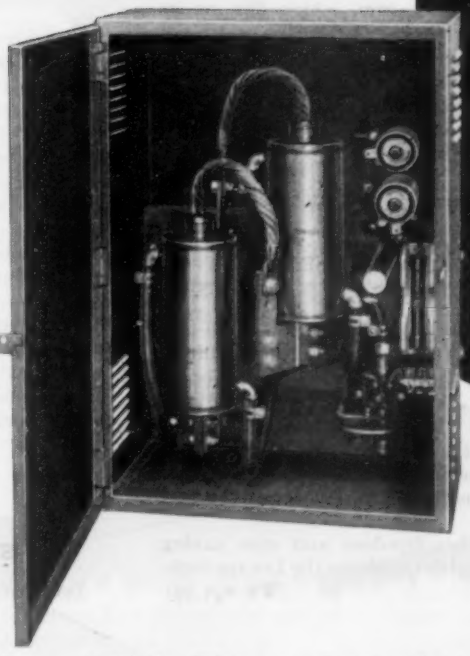

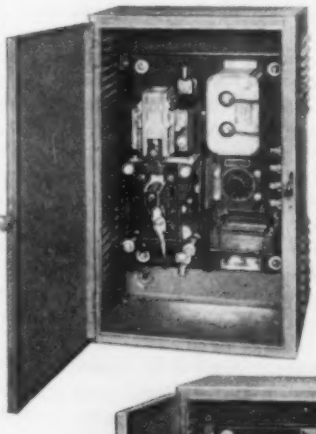

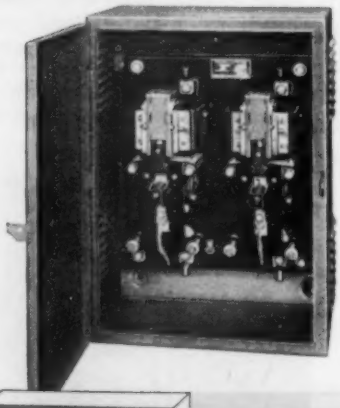

With Three Complete Lines Square D has the right contactor for each resistance welding job

Electronic contactors for jobs involving heat control, very short weld periods at heavy currents, or exceptionally high speed operation.

SYNCRO-BREAK contactors for production jobs where lower installed cost and economical operation are important. Especially desirable where welders must operate over a wide range of weld times and duty cycles. Synchronizing feature eliminates arcing and prolongs contact tip life.

HIGH SPEED contactors, single or two-pole, for greatest economy on jobs where loads are smaller and duty cycles less severe. Designed specially for welder service, with knife-edge bearings, low-inertia moving parts and powerful blowout coils.

Write for BULLETIN 8990, describing all three lines of contactors. Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin.

Square D builds *Safront* weld and sequence timers suitable for use with any of the three contactor designs. Write for BULLETIN 8991.

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brass, bronze and aluminum. In addition, the electrodes are available for hard facing for maximum hardness. All popular sizes are featured.

Those interested may secure a copy of this publication simply by writing to the Eutectic Welding Alloys Corp., 40 Worth St., New York 13, N. Y.

BETATRON

Picatinny Arsenal at Dover, N. J. was host to more than 60 editors of newspapers, technical magazines and professional journals from all parts of the country, who came to the Arsenal to view the first demonstration of the 20,000,000-volt betatron manufactured by the Allis-Chalmers Corp.—a machine whose rays can penetrate 20 in. of steel in 20 min. and detect flaws of almost microscopic dimensions.

During an Arsenal meeting, presided over by Prof. D. W. Kerst, University of Illinois Physicist and inventor of the betatron, the editors heard a discussion of the various phases of the betatron's development, including an earlier installation at the Rock Island Arsenal and its application on some of the work in the Manhattan Project.

Editors heard the betatron described as a dependable, fool-proof and economical tool for all industry and exhibited keen interest in the characteristics of betatron radiation which enables its rays to penetrate the thickest steel. In addition, it was shown that the betatron makes enlargements on radiograph film directly. The unit is housed in a special X-ray laboratory at the Arsenal.

Allis-Chalmers was host to the newspapermen during a luncheon at the Harbor Restaurant in Parsippany.

The betatron, simply considered, is a two-winding transformer with a stream of electrons for a secondary winding. The secondary high-voltage winding, instead of being made up of the hundreds of thousands of turns of very small wire which would be necessary to produce 20 million volts, is replaced by a simple donut-shaped vacuum tube. Projecting into the tube is a sturdy filament and a tiny platinum target.

When a rich supply of electrons is shot from the filament into the vacuum inside the donut, the magnetic flux acts on them in much the same manner as if they were moving inside the turns of wire. The betatron steel core is made with a small air gap in the center leg, allowing the donut and a specially designed circular steel pole piece to be inserted. As the magnet or core is energized, the flux surrounding this circular pole piece builds up and acts to keep the electrons in a circular orbit while accelerating them.

In the $^1/_{720}$ of a second that all of this takes place the electron stream races around the inside of the donut several hundred thousand times, nearly approaching the speed of light. At the peak of their speed, a pulse of current from an electronic circuit in the betatron control upsets the magnetic field and the electrons spiral off and collide with the tip of the small target.

At this terrific speed, the energy which the electrons give up in the collision with the target creates a rich supply of very high-frequency X-rays which emerge through the walls of the donut as if they did not exist.

The betatron, by combining a transformer winding and an X-ray tube in one small porcelain donut becomes one of the first tools of the atomic age for industry, medicine and science.

A competent laboratory technician can operate the betatron, which has, as its biggest advantages the greatly increased speed and far greater detail with which X-rays can be made. Instead of X-raying one out of 50 or 100 or more units of heavy equipment, it will be practical to X-ray every piece produced.

HELP FOR DESIGNERS AND FABRICATORS OF PRESSURE VESSELS

The Lenape Hydraulic Pressing & Forging Co. has just published a new bulletin illustrating the wide range of press-forged welding necks, nozzles, manways and hand-holes which they produce. Included are all of the standard and many of the typical, special types of connections and openings used in pressure-vessel fabrication.

The design freedom and cost saving features made possible by the Lenape technique are plainly evidenced in the many illustrations contained in this interesting new bulletin.

For your copy of Bulletin 4-61 write, Lenape Hydraulic Pressing & Forging Co., Dept. 7, Westchester, Pa.

MACHINABLE ARC WELDS IN CAST IRON

A four-page instruction bulletin for making machinable arc welds in gray iron castings has just been issued by C. E. Phillips & Co., 1750 Poplar St., Detroit 8, Mich. The instructions include current settings, arc manipulation and preheating temperatures. Diagrams show how to avoid overheating of the casting in typical applications. Metallographic studies and hardness surveys are used to explain the recommended procedures. A weld-tempering method is described which reduces the tendency to cross checking in the weld metal

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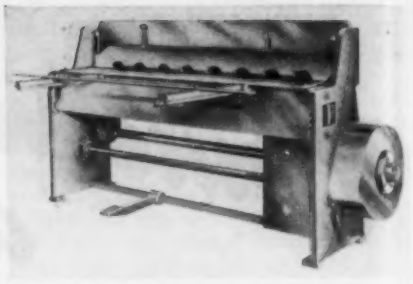
POWER SQUARING SHEARS

Parker Manufacturing Co., Santa Monica, Calif., introduces a new line of all-steel power squaring shears for all types of shearing and trimming up to 14 gage capacities, to be known as Parker Power Squaring Shears. Built from extra-heavy steel plate of box-type design, welded and normalized to relieve stresses, Parker Shears possess maximum strength with minimum deflection.

Standing only 47 in. high, Parker Shears



have a low center of gravity for smooth, vibrationless operation. Cutting length is 73 in., blade length, 75 in. Back gage range 18 in., front gage range 38 in. Strokes per minute (50 or 60 cycle), 85. Two hp. motor furnished with each Shear. Approximate shipping weight, 2750 lb.

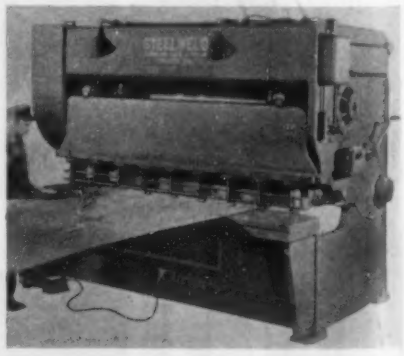
Four-way, high-carbon tool steel blades last longer and reduce grinding time. Extra long gibways insure long blade life and straight line shearing. Parker Shears will cut drawn or folded parts within $1^1/_2$ in. of the shoulder, thus deep-drawn objects (sinks, basins, cowlings, etc.) may be trimmed closer. Parker Shears are sold with a guarantee and are ready for immediate delivery.

STEELWELD SHEARS

Control of Steelweld Shears built by The Cleveland Crane & Engineering Co., Wickliffe, Ohio, has been made extremely easy and convenient by a new type electric foot control which has been adopted as a standard feature on all size machines.

A safety-type switch, connected to an outlet at front of the machine by a heavy cable, controls the movement of the blade. The switch can be slid around the floor to wherever most convenient to use. When shearing is done on a continuous production basis, the foot switch reduces the fatigue of the operator considerably. The foot switch requires only a slight movement of the toe, whereas with the usual mechanical foot treadle the entire leg must be raised several inches for each cut.

The electric control is especially advantageous when cutting long sheets necessitating the operator being several feet from the front of the machine. For instance, when cutting quantities of narrow strips from long sheets of metal, the



This Machine Cuts Plate Up to $^3/_8$ In. by 8 Ft. 0 In., Has Speed of 50 Strokes per Minute

For more than 30 years, K-G Welding and Cutting Company has manufactured welding and cutting torches and regulators with a single purpose in mind—to produce only the finest possible oxy-acetylene apparatus. That this aim has been achieved is demonstrated by the fact that with few distributors and little sales effort, K-G apparatus is in use far and wide. K-G torches and regulators have literally sold themselves . . . have proved so efficient and economical that many users have ordered and re-ordered *by mail* for many years.

Now, as a subsidiary of Air Products, Incorporated, K-G is putting into operation an entirely new and broader sales policy designed to make the K-G line available everywhere for direct purchase. New items are being added to provide a complete line of superior equipment for every welding and cutting requirement. Soon there will be authorized K-G distributors, with complete stocks and factory-trained repair experts, in all principal cities. In the meantime, users of apparatus are invited to learn more about the superior K-G line. Write today for the K-G Catalog—address K-G Welding and Cutting Company, Dept. 120, 515-19 W. 29th Street, New York 1, N.Y.

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TO USERS OF OXYGEN: Air Products, Incorporated, manufacture equipment for the economical production of oxygen, nitrogen and hydrogen by the user of more than 200,000 cubic feet per month. Learn how you can cut costs and speed production by producing your own gases with Air Products equipment—write for details. Address Air Products, Incorporated, Dept. B, Box 538, Allentown, Pa.

the operator can push the sheet at the end and slide the switch along the floor as the sheet becomes shorter. Because of the ease and convenience of the foot control, production can be increased materially.

WELDED PROTECTIVE COVERS

Installing protective covers, fabricated of wrought-iron plate, over spalled concrete spandrels is the latest technique devised for this type of building maintenance.

Milton C. Hartman, Chicago consulting engineer, theorized that such an installation would be more feasible than to attempt repair of concrete spandrels between the columns of an eight-story building occupied by Aldens, a mail order firm of Chicago. The spandrels were severely spalled by atmospheric attack and in need of immediate attention. Recalling how wrought-iron plates are installed on submerged concrete piers and similar structural members which are subject to damage from water and ice, Mr. Hartman designed "channels" of $^3/_{16}$-in. wrought-iron plate to cover the building spandrels.

Mortar was chipped out over each spandrel to a depth of $1^1/_2$ in. and the channels were slipped into place, being well caulked with a high-grade mastic and secured by expansion bolts.

Besides "dressing" the exterior appearance of the building, this type of maintenance construction provides additional structural strength, according to the installing contractor, Rossbach & Sons, Chicago.

Fabrication of the channels presented a problem due to the angle of the bend. It was decided, however, that the bend radius of $^3/_4$ in. did not exceed wrought iron's maximum elongation of 14% because the axis of the bend was at right angles to the direction in which the plates were rolled at the mill.

Because the standard maximum width to which wrought-iron plates are rolled is less than 18 ft. 6 in.—the length of the spandrels—it was agreed that the channels could be fabricated of four lengths of $^3/_{16}$-in. plate, each $55^1/_2$ in. in length, welded together to the necessary over-all length.

The channels were cold bent so that the lower leg was $4^1/_2$ in. wide, forming the underside. It was pitched slightly for drainage. The top leg, fitting over the top of the spandrel, was $1^3/_4$ in. wide, while the channel web was about $9^1/_4$ in. deep.

Use of wrought-iron sheeting considerably thinner than $^3/_{16}$-in. plate has been widely recognized for its resistance to corrosion and has been used for roofing and siding since the middle of the 19th century. The old Union Station in Atlanta, Ga., was built with wrought-iron sheeting that provided a maintenance-free service life of 60 years before the structure was razed.

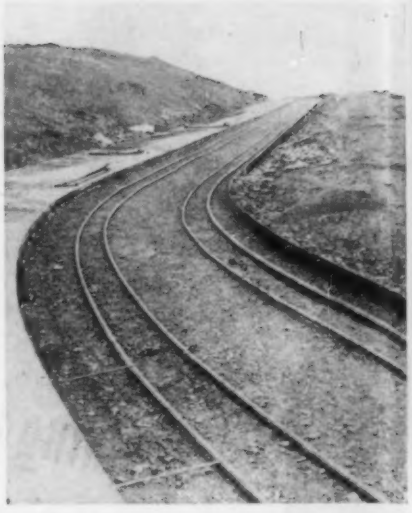
SNOW REMOVAL

To eliminate the hazard and delay that could be caused by winter's snow and ice on a 600-foot long, two-lane roadway leading into the Bridgeville, Pa., plant of American Cyanamid Co., engineers of that firm have designed a unique snow-removal system consisting of hot water pipes embedded in the concrete pavement.

The road, 24 ft. wide, is on a constant up-grade from the plant to a main thoroughfare. Snow and ice would make it virtually impassable, creating a severe traffic problem especially during shift changes.

Company engineers conceived the idea of planting pipes in the roadway after they learned of the success of similar snow-melting systems in loading areas and sidewalks at other industrial plants and residences. The structural principles involved in designing and installing the system are somewhat related to those encountered in radiant heating work.

Now completed and ready for operation this winter, the snow-melting road is constructed of an 8-in. concrete slab, resting on graded earth. Embedded in the concrete at the bottom of the slab, are eight lengths of black wrought-iron pipe, positioned on the road bed in such a manner as to provide two pipes 18 in. apart beneath each wheel track in both lanes.



Sloping Down the Side of a Hill from a Main Thoroughfare Into the Bridgeville, Pa., Plant of American Cyanamid Co., This Two-Lane Driveway 600 Ft. Long, Has Been Constructed with Wrought-Iron Heating Pipes Embedded in the Pavement to Melt Away Snow and Prevent Ice from Forming

These pipes run the entire 600 ft. from the main thoroughfare to a small bridge near the enlarged employees' parking lot. The pipes are welded at each end of the run to wrought-iron header pipes 4 in. in diameter.

Hot water, at an average temperature of 165° F., will be circulated through these pipes approximately 50 gpm. against a head of 17 ft. The water is to be heated by steam from the plant's boilers in a converter used especially for the snow-melting system.

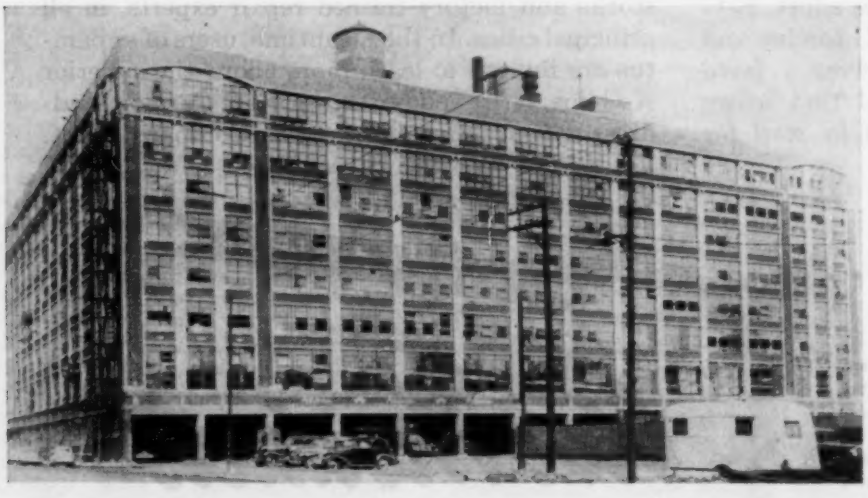
Sufficient anti-freeze solution will be added to the system to prevent freezing during periods of nonoperation.

Under maximum operating conditions, the system is expected to accomplish the removal of a minimum of 1 in. of snow or one-tenth of an inch of ice per hour. Engineers have calculted that snowfalls in excess of this rate are unusual and it is not considered practical to design such melting systems for greater capacity.

As insurance against air lock in the system, two air vents were tapped into the piping layout at the highest point and provisions for drainage were installed at a low point.

The pipe runs, based upon engineering experience, are estimated to provide snow-free, ice-free wheel tracks about 2 or 3 ft. in width. Heat, transferred from the buried wrought-iron pipes to the concrete will warm the pavement sufficiently to melt snow and prevent ice from forming. Residual water will be quickly evaporated from the warm surface by natural air currents.

This system of melting snow is one that is being studied with considerable interest by many engineers throughout the country for the idea of eliminating costly and time-consuming manual snow-removal operations has significant appeal. Frequently, manual snow-removal efforts are ineffective due to snow drifting and falling with such rapidity that as soon as one area is cleared, it quickly becomes covered again.

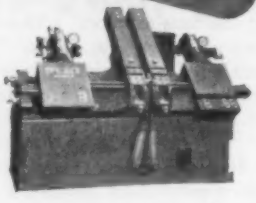


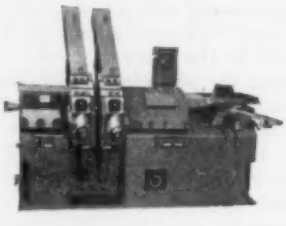
Repair of Spalled Concrete Spandrels on This Eight-Store Building That Covers a Square City Block in Chicago Would Have Been Uncertain and Impractical. Use of Wrought-Iron "Covers" on the Spandrels, However, Improved the Building's Appearance and Provided Additional Structural Strength

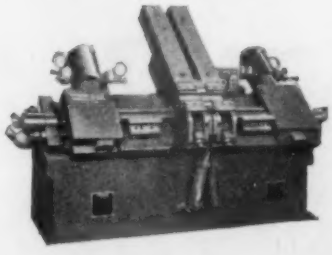
Sciaky Announces a Complete Line of *Advanced** Flash Welding Equipment

A machine for most every flash welding job—mitred sash, bar and tube stock, castings, etc.—is included in this series of *modern* welders. Revolutionary features in design and construction put these machines years ahead—in weld quality, flexibility and long life. Capacities range from .90 sq. in. cross sectional area on small hand-operated machines up to 5 sq. in. on large, completely automatic power-operated welders.

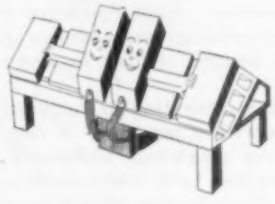
*and here's what we mean by **Advanced**



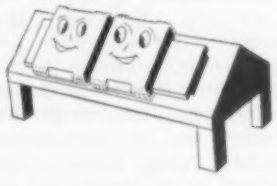




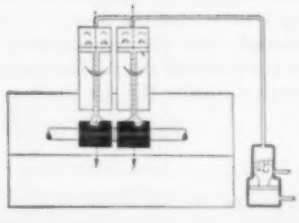
FRAMES are constructed as a sturdy, self-contained beam. Conductors from transformer to dies are placed *outside* the frame—eliminating need for weakening cutout and protecting transformer from flash sparks.



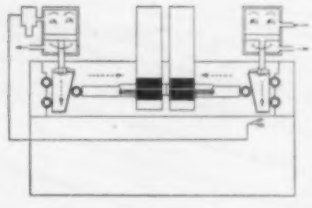
PLATENS move on a wide, rigid, T-shaped bed. Stresses are distributed over both upper and lower large, flat bearing surfaces. Accurate guiding is assured by narrow key. Tapered gibs maintain proper clearance.



CLAMPS are actuated by a booster-supplied high pressure hydraulic system. This allows cylinders of small diameter to be used which can apply force *directly in line* with clamps.



FLASHING and UPSETTING is controlled by air cylinders driving wedge-shaped cams between rollers. On power-operated welders, both platens move to allow independent control of flashing and upsetting. Heavy duty machines are equipped with two transformers—one connected to upper dies and the other to lower dies. Thus, perfect distribution of heat is assured on work such as large tubes.



SCIAKY

Ask for Bulletin 130-A

Informative 32-page booklet sent on request—write

SCIAKY BROS., INC. 4925 W. 67th St CHICAGO 38, ILL.

Several department stores in New York City and elsewhere are now installing snow melting systems of this kind to keep their sidewalks free from snow thereby offering added convenience for customers without the use of chemicals or snow shovels.

Proof that such systems are effective was offered last winter at the plant of a rubber company in Buffalo, N. Y., where wrought-iron snow-melting pipes are embedded in the concrete driveway. The system kept the driveway free from snow during the heaviest snowfall in Buffalo's history, when 68 in. fell within a few days.

Automatic snow-melting systems do not necessarily have to be kept in operation at all times. They can be turned on when snow is predicted—or when snow begins to fall. One manufacturing plant has rigged a delicately balanced metal plant that activates a circulator pump forcing water into the snow-melting system when snowflakes fall.

RADIANT HEATING SYSTEM

Probably no buildings are more adaptable for radiant heat than industrial facilities, public structures and aircraft hangars because construction projects of these types generally involve huge expanses of uninterrupted floor space, nearly always have concrete floors and are high-ceilinged and basementless. Under ordinary conditions, such buildings pose complex problems for the designer of space heating systems.

Radiant heat, operating on the principle of radiation with a minimum of convection, achieves maximum uniformity of heat distribution both horizontally and vertically. Stratification of hot air currents are virtually eliminated. Heat energy, transmitted by conduction from piping systems to the concrete slabs in which they are embedded, travels through the air in the form of radiant energy which does not disturb the air mechanically. When the radiant energy strikes a solid object, radiations are re-transformed into heat energy that warms the object or surface. Although the air temperature is raised to a comfortable degree by contact with warmed surfaces, the air itself in a radiant heating system is not the major comfort-producing medium. Air currents are not the means of distributing heat as is the case with conventional heating.

During the past 10 years, many different design techniques have been employed for the several thousand radiant heating systems now in operation in this country. All designs, however, are based upon either the serpentine coil pattern or the grid element. In one of the hangars to be described, the serpentine coil pattern was used; in the other, the grid pattern was used.

The Packard Motor Car Co.'s new flight test facility at Willow Run, designed by Giffels & Vallet, Detroit, is of concrete block construction with a flat truss roof. It is 158 x 158 ft. in size and is divided into four separate heating zones. Two zones, each 22 ft. wide and 150 ft. long, are located parallel to each end of the hangar where door openings create high heat loss. The heating grids in each of these two zones consist of 32 wrought iron pipes, $1^1/_4$ in. in diameter and 150 ft. long, spaced 8 in. on centers. Each grid pipe is welded into 4-in. header pipes, connected on one end to the supply main and on the other end to the return main. There are two other heating grids in the central portion of the structure. Each is fabricated of 45 wrought iron pipes $1^1/_4$ in. in diameter, spaced on 15 in. centers. The two zones served by these grids are 158 ft. long and 57 ft. wide.

Four straight-tube converter type water heaters supply the grids. Water is circulated by four 200 gpm. pumps, each pumping against a 60-ft. head. An oil-fired boiler furnishes steam at 10 lb., through pressure-reducing valves, to the water heaters. Heat input for the two zones along the two ends of the hangar is controlled by outdoor thermostats while the input to the interior heating grids is controlled by proportioning-type wall thermostats.

Wrought-iron radiant heating grids were buried in 6 in. of concrete, poured over a 2-in. insulating concrete slab. Expansion joints in the slab were run parallel to the grid pipes so that expansion joints in the piping system proper were required only at six locations.

In contrast with the grid-type radiant heating system at the Packard hangar, a sinuous-type coil system was installed at the General Electric Co.'s new flight test hangar at Schenectady, N. Y.

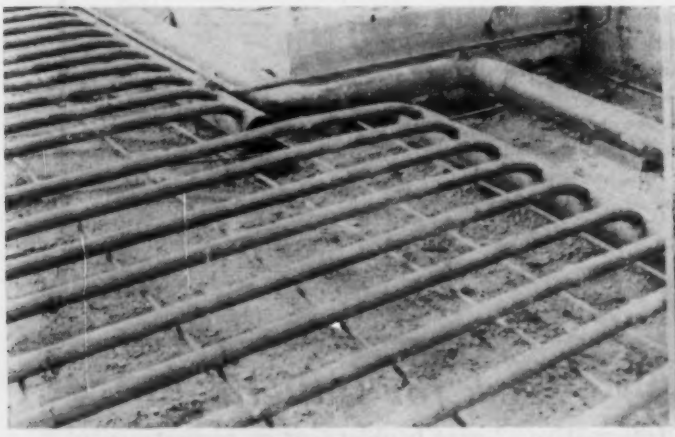
Inside dimensions of the General Electric structure are 168 ft. 8 in. by 168 ft. 8 in., with the high point of the roof being 45 ft. above grade and the low point, 17 ft. above grade. It is of reinforced concrete construction.

The floor area was divided into 20 individual heating sections, each having a continuous coil of $1^1/_4$-in. wrought iron pipe, welded and cold-bent into shape. Wrought-iron pipe is used for most radiant heating systems because of its thermal expansion coefficient (virtually the same as the concrete in which it is embedded), the ease with which it can be bent and welded, its ability to resist damage during fabrication and its resistance to interior and exterior corrosion.

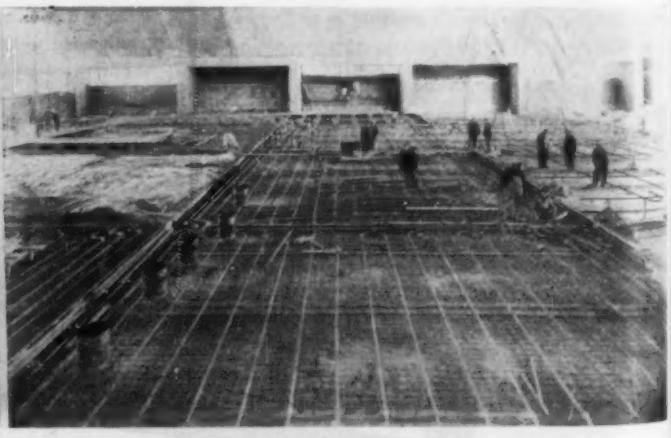
Nine of the floor sections in the GE hangar are approximately 40 x 40 ft. each. In these sections, the pipe is spaced on 24 in. centers. Eight other sections, each approximately 40 x 26 ft. with pipe spaced on 12 in. centers, are positioned along the east and west walls of the hangar, four sections on each side. Three other sections, 40 x 40 ft. each with pipe spaced on 12 in. centers, are located parallel to the north end of the building where the sliding doors expose the entire north side.

To provide a level base for the pipe coils, a $1^1/_2$-in. rough concrete slab was poured on the fill. On this base, angle iron supports $1^1/_2$ x $1^1/_2$ x $^3/_{16}$ in. were positioned over reinforcing rods. After the coils were positioned on the angle iron supports, they were covered by $6^1/_2$ in. of concrete which formed the finished floor. This made the floor slab a total of 8 in. thick. The pipes are positioned approximately at the neutral axis of the slab and are pitched 1 in. in 80 ft., east to west, being level north to south. Wherever supply or return-branch mains to the 20 individual coils pass through construction joints in the floor slab, flexibility is provided by expansion loops covered with asbestos cell insulation jacketed with roofing felt, all of which is buried in the concrete.

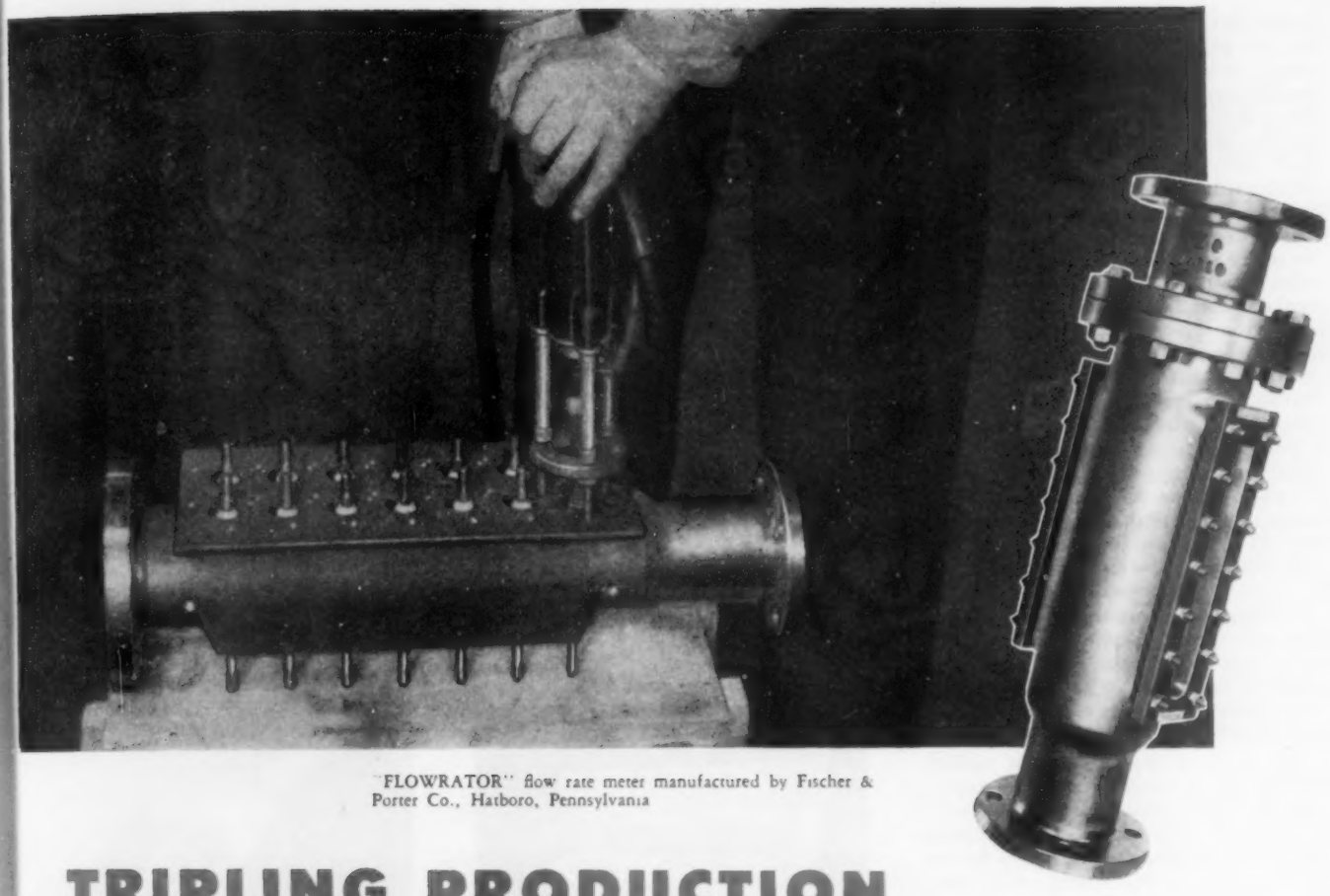
Since the pipe size and spacing and the mean water temperature are the determining factors for heat output per hour per



Closeup Shows How Grid Pipes in the Packard Hangar Are Welded Into Supply Mains



General View of the G.E. Hangar, Showing Wrought Iron Radiant Heating Coils in Position Before Concrete Sections Were Poured



"FLOWRATOR" flow rate meter manufactured by Fischer & Porter Co., Hatboro, Pennsylvania

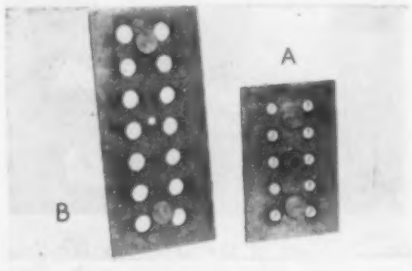
TRIPLING PRODUCTION at the pull of a trigger . . .

It takes 28 studs to secure the two gauge glass hold-down flanges on the Fischer & Porter "Flowrator" pictured above. Formerly, stud installation required drilling 28 holes in the stainless steel casting, tapping each of the 28 holes, and screwing in 28 studs . . . 84 slow, costly operations per unit.

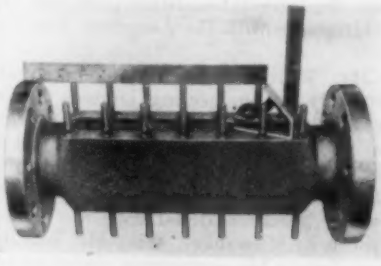
NELSON Automatic Stud Welding trebled production by reducing stud installation to one trigger-quick operation per stud. The operator merely loads the NELSON flux-filled stud with its protective ferrule in the gun chuck, locates the gun legs in the simple template shown, and pulls the trigger. A standard d.c. welding generator furnishes the current, and the NELSON Timer Control unit automatically times the weld cycle. On the job illustrated, the operator averages 150 stud welds per hour.

A three-fold increase in production was but one of the advantages Fischer & Porter gained by adopting NELSON stud welding. Because no holes are drilled in the casting, possibility of leaks around stud holes are eliminated. Slight porosities in the casting encountered in drilling stud holes required expensive filling, or discard of the casting. As no holes are now drilled, porosities are no longer a problem and casting rejects are at a minimum.

If your product uses studs, there's a very good chance that you, too, can save hours and dollars with NELSON Automatic Stud Welding. Full details are yours for the asking . . . write or wire us *now*.



SIMPLE TEMPLATES ASSURE ACCURACY, HIGH PRODUCTION SPEED—Fischer and Porter use two types of inexpensive templates made from ¼" plate to speed accurate stud location. The "tight hole" type (A) locates by means of pilot holes drilled to take the NELSON ferrules with a snug fit. Ferrules are dropped in place and studs welded through ferrules. The "leg positioning" type (B) locates by means of 3 countersunk spots to match the 3 gun leg tips.



Extreme accuracy of location, stud height and alignment are demonstrated in the photo above.

NELSON SALES CORPORATION

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Representing

Nelson Stud Welding Corporation Lorain, Ohio	Nelson Specialty Welding Equipment Corporation San Leandro, California

NELSON

TRADEMARK

square foot of floor space, it was decided that the pipes along the side walls of the hangar and parallel to the door opening should be spaced on 12 in. centers. Heat losses by conductance and infiltration in these areas are greatest. One of radiant heat's advantages in a hangar is that comfort conditions are not affected by infiltration of cold air, either from the large door openings or ventilating system, as long as the major structural surfaces remain adequately warm. These warm surfaces regulate the amount of radiation heat losses from the body and will maintain comfort despite irregularly low air temperatures caused by opening of doors. Furthermore, restoration of normal air temperature after it has been depressed in a radiant heated building is achieved quicker than in a conventionally heated structure. Tests in one radiant heated hangar showed that the air temperature dropped 22° when the large doors were opened but that this loss picked up in only $6\frac{1}{2}$ min. after the doors were closed.

Welding operations on the wrought iron pipe coils were facilitated by raising the coils a few feet off the floor with hoists mounted on tripods. In this way, the entire heating coil was welded while suspended and then lowered into position.

Hot water is supplied to the radiant heating system from two U-type copper tube heat exchangers, each having a capacity of 11,000 gph. with a water temperature rise of 90 to 130° F. Steam for the heat exchangers is regulated to 5 lb. pressure. It is furnished from two oil-fired, cast-iron sectional steam boilers, each having a gross output rating of 9560 EDR. Two single-type centrifugal pumps, each with a rated capacity of 200 gpm. and a total pressure of 55 lb., are used to circulate the water. Temperature control is accomplished by a combination outdoor-indoor thermostat.

The wrought-iron supply mains, ranging in size from 3 to 5 in., are run below grade along the south wall to five heating pits, each approximately 4 ft. 8 in. wide by 7 ft. long by 2 ft. 6 in. deep. In these pits, branch supply lines, ranging from $1\frac{1}{4}$ to $2\frac{1}{2}$ in., are connected. Return lines from each pit are connected by risers along the south wall to the return main, which is located overhead to facilitate venting of the system. Smaller air vents are located under access covers at the high points of the individual coils.

Marcus T. Reynolds Co., architects, Albany, N. Y., designed the new GE hangar. The radiant heating system was designed by J. L. Ottenheimer, Albany, and was installed by Heating Maintenance Corp., New York City. General contractors were Corbetta Construction Co., New York City, and Roberts & Schaffer, Chicago, were concrete engineers.

Under general conditions, design of a radiant heating system—using either the serpentine coil or the grid pattern—is based upon heat transmission values of approximately 3.5 Btu. per hour per square foot of external pipe surface and per degree F. temperature difference, water to air. Conventional heat loss factors are used to determine heating requirements. In most radiant heating systems, the practice has been to design the system for the use of 140° F. water, which is considered sufficient to increase the slab temperature to about 85° F.

A WELDING JOB WITH TEETH IN IT

This 10-ft., cast-steel, sand drier gear, weighing about 3300 lb. and having 104 teeth 10 in. wide, was recently rebuilt by

Fig. 1—Cross Section of a Gear Tooth Showing: (A) Outline Produced by Wear, and (B) Shape to Which Tooth Had to Be Rebuilt

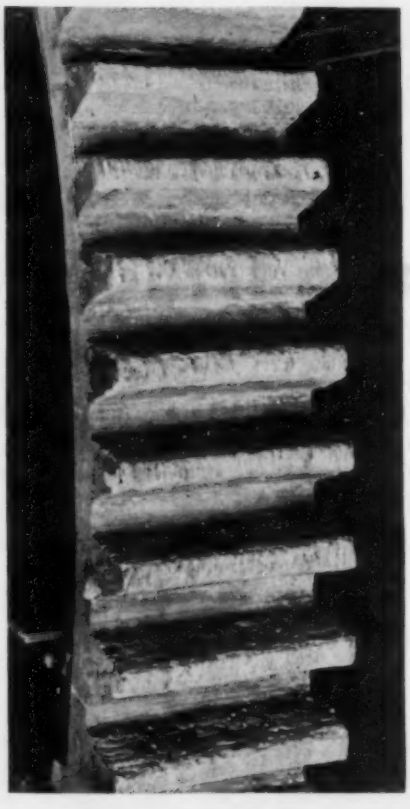

Fig. 2—View of the Teeth on the Sand Drier Gear After Rebuilding with "Two-Tone" Welding. Very Little Grinding Was Necessary Since the Weld Was Fairly Smooth. "Two-Tone" Welding Will Give This Gear Longer Life

"two-tone" welding at Griff's Welding Shop, Coatesville, Pa. The teeth were badly worn to a knife edge, but were rebuilt by using 700 lb. of $\frac{3}{16}$- and $\frac{1}{4}$-in. General Electric W-20 electrodes and a cast-iron core rod. This gear was back in operation after a delay of less than two weeks, involving 237 man-hours of welding.

HERBERT L. WHITTEMORE, U. S. ENGINEER, RETIRES

Herbert L. Whittemore, mechanical engineer at the National Bureau of Standards, retired on October 31 after 29 years of continuous Government service, it was announced by Dr. E. U. Condon, Director of the Bureau. Mr. Whittemore, an authority on the testing of engineering materials, has been chief of the Engineering Mechanics Section since 1918.

Herbert L. Whittemore

In recent years Mr. Whittemore has carried on a program of testing components for prefabricated houses, studying possibilities for placing the mechanical design of small houses on a rational basis. He has directed extensive mechanical tests of engineering materials, organizing such work along intensely practical lines in close relation with other Government agencies and with industry. Such efforts led to cooperative research projects in investigations of the strength of welded joints, pressure vessels, steel cables, thread locking devices, rigid frames, stainless sheet, steel columns and welded steel girders. His mechanical ingenuity in conducting these tests led to the development of the Whittemore Strain Gage and the Whittemore-Petrenko Proving Ring, which has become a standard piece of equipment in checking the accuracy of tension and compression testing machines. In recognition of the value of this contribution the Franklin Institute presented Mr. Whittemore with the *Longstreth Medal* in 1938.

Mr. Whittemore has contributed extensively to engineering journals in the field of engineering mechanics. For his basic research in oxyacetylene welds and his success in promoting the use of safe-fusion welding, he was awarded the *James Turner Morehead* Medal in 1928.

Born in Milwaukee, Wis., Mr. Whittemore began his engineering career as an apprentice machinist in Milwaukee, Chicago and Hartford. After receiving his en-

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The AMERICAN WELDING SOCIETY

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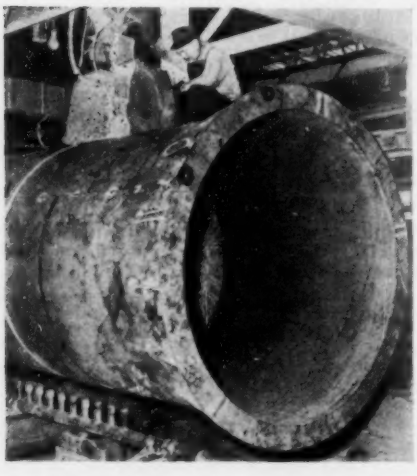
gineering degree in 1903 from the University of Wisconsin, he held responsible positions with companies in this country, Germany and England. In 1906, Mr. Whittemore took charge of the undergraduate laboratory work in testing materials and hydraulics at the University of Illinois where he began his research on oxyacetylene welds in steel. Following two years as Engineer of Tests at Watertown Arsenal, he joined the faculty of Columbia University as an instructor in mechanics and in 1916 became professor of mechanics at the University of Oklahoma. In 1917 Mr. Whittemore was called to the National Bureau of Standards to direct mechanical tests of large quantities of war material streaming into the Bureau.

During his career at the Bureau, Mr. Whittemore has been active on 26 committees of engineering societies such as the American Society of Mechanical Engineers, the American Society for Testing Materials and the AMERICAN WELDING SOCIETY. A strong advocate of "performance specifications" based on tests, he advanced the cause of such specifications by his membership on 24 committees of the Federal Specifications Board and the American Standards Association.



High Pressure Tank

Section of a huge high-pressure tank being welded for Stearns Roger Manufacturing Co. at General Iron Works, Denver. Sections 10 ft. long, 2½ in. thick, and having an inside diameter of 5 ft., are welded together to make a tank 70 ft. long and weighing 56 tons with General Electric automatic arc-welding equipment using ¼-in. electrode.

The nozzle arrangement beneath the tank is a device for preheating both sides of the weld with Skell gas to a maintained temperature of 350 degrees.

OBITUARIES

Charles D. Young

Charles Drew Young, Sales Manager of the Metal & Thermit Corp., died on Nov. 16th at the Orange (N. J.) Memorial Hospital after a brief illness. Mr. Young was born in Charles City, Iowa, June 30, 1888. He received his education in the Chicago Public Schools and at Armour Institute of Technology and made his home in Chicago until three years ago.

Mr. Young joined the Metal & Thermit Sales organization in 1911 and in 1930 was made District Manager in Chicago. In 1943 he was appointed Sales Manager with headquarters in New York City. He was a Vice-President of the National Railway Appliances Association, having served

Charles D. Young

a number of years on its board of directors, and was a member of the Executive Committee of the Chicago Section of the AMERICAN WELDING SOCIETY. He was also a member of Chicago's South Shore Country Club and of the Canoe Brook Country Club, Summit, N. J.

* * *

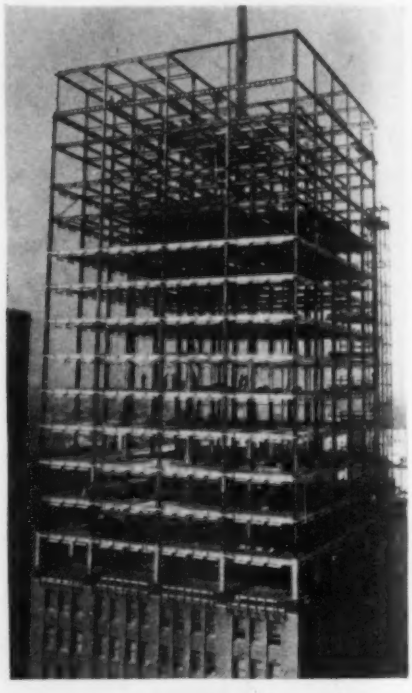
R. Sarazin

Word has just been received of the death on August 15, 1946, of R. Sarazin of Neuilly, France. Mr. Sarazin contributed greatly to the development of welding in France. He pioneered in welding just after World War I. In 1923, he founded a small plant, during the depression, and at the beginning had a lot of difficulties, as the people in France were not in favor of welding at that time. Owing, however, to the originality of his patents, his energy and tenacity, his business became a fair success, and he soon lead the French welding industry. He was a member of the AMERICAN WELDING SOCIETY since its beginning.

Mr. Sarazin's business and membership in the SOCIETY is being carried on by his son, Jean Sarazin.

FOURTEEN STORY ADDITION TO BUILDING WELDED

The photograph shows the fourteen story structural steel frame addition to the National Standard Building, Houston, Texas, now under construction by the W. S. Bellows Construction Co. Almost nine hundred tons of steel have been erected for this addition and the completed structure will have twenty-two floors. The original building is constructed of reinforced concrete, and bearings for columns were provided by welding leveling plates to reinforcing bars and grouting between the top of the original column and the plate. Structural steel was one hundred per cent shop and field welded in accordance with AMERICAN WELDING SOCIETY specifications, and in general the beam to column connections were made with fillet welds between the seat plates and bottom flanges of beams and 45° bevelled butt welds attaching top flange moment plates to columns.



The addition to the above structure was designed by A. C. Finn, Architect, and W. E. Simpson, Engineer, and shop and field welding was supervised by Southwestern Laboratories.

Employment Service Bulletin

SERVICES AVAILABLE

A-537. Welding Consultant. Prominent Welding Engineer, M.E. degree, nationally known author of books on welding, authority on engineering materials and fabricating processes, seeks responsible position with consulting engineering firm; metal fabricating industry; construction, or educational institution.

A-538. Welding Engineer. Production, sales or research. Los Angeles area. Metallurgical background with 20 years experience in light and heavy gage fabrication, ferrous and non-ferrous, arc, gas, resistance, induction, submerged melt, physical and chemical research. Member principal metal societies.

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REVERE NO. 456 LOW FUMING

BRONZE WELDING ROD

A WELDER breathes air, not fumes, when he uses Revere No. 456 Low Fuming "Flame Tested" Welding Rod. And he produces finished welds with higher strength in the weld metal. He can save time and fuel in the straight fusion welding of cast iron, because the low melting point of this Revere rod cuts down the need for high pre-heats and the post-heating often required. Revere No. 456 produces strong, sound joints in the bronze welding of cast and malleable irons, wrought iron, cast and wrought steel, as well as cast and wrought bronze.

Other Revere welding rods are: Revere Bronze 380, Revere Manganese Bronze, Herculoy, Revere Phosphor Bronzes, Revere Brass (Brazing Rod), Revere Silicon Deoxidized Copper, Revere Phosphor Deoxidized Copper, and Revere Electrolytic Copper. They come in 100-pound cases or in 25-pound cartons, net weight, and are handled by Revere Welding Rod Distributors in all parts of the country. Write for folder giving technical data and net prices.

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NEW PRODUCTS

The Society assumes no responsibility for the validity of claims in this Section

AIRCO ANNOUNCES NEW ALUMINUM BRAZING FLUX AND WIRE

Elite Aluminum Brazing Flux, another product of Airco research, has been developed exclusively for aluminum brazing and is now made available to meet the demand for a high grade yet economical flux with a satisfactory low melting point. Due to Airco Elite's physical properties, Airco #26 Wire, widely used throughout industry for general-purpose welding, is now made available for brazing 2S, 3S, 53S and 61S aluminum.

Alcoa #716 Brazing Wire, well known to fabricators of aluminum products and now being distributed to the trade by Air Reduction, is highly recommended for brazing 53S and 61S aluminum alloy analyses. Both Airco #26 and Alcoa #716 achieve excellent results in the fabrication of a wide variety of aluminum products from cooking utensils and electrical appliances to metal furniture, window frames and other extruded aluminum shapes.

For further information on these three products write to Air Reduction, 60 E. 42nd St., New York 17, N. Y., or contact any local Airco office.

A.-C. WELDERS

Construction details, electrical specifications and application data on the complete line of a.-c. transformer type welders are contained in a new booklet announced by the Westinghouse Electric Corp.

Detailed information is given on the 500- and 400-amp. industrial welders for fast, steady production; the 300-amp. welder for heavier-than-average work; and the general duty welders ranging from 20 to 250 amp. Electrical specifications and performance data are presented in chart form for easy reference. The booklet is fully illustrated with interior views and close-ups of special features, as well as exterior views of each model. General application information concerning recommended electrodes is also included.

According to the booklet, a.-c. welders will increase speed 20 to 30%, reduce power costs one-third and reduce maintenance costs.

Copies of the booklet (B-3548) may be secured from the Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

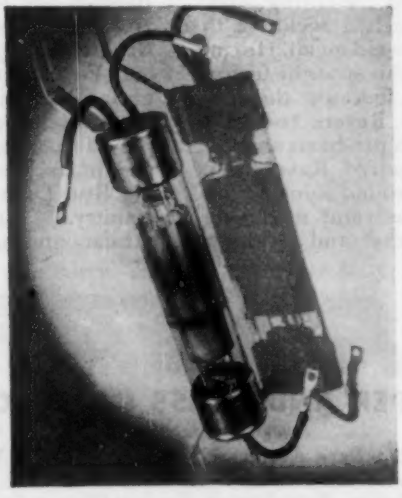
NEW ELECTRODE FOR AUTOMATIC WELDING

Under U. S. Pat. 1,865,169 owned by The Reid-Avery Co., Baltimore, this firm is manufacturing and marketing a new type of automatic arc welding electrode. Called Raco Composite Type A, this electrode is designed to increase the efficiency of automatic arc welding. Among its features are the elimination of slitting shielded arc coatings to obtain contact with wire, and the doing away with the wrapping of shielding materials on the wire during operation. This electrode likewise does away with the recovering of unused melt.

The entire manufacturing process, the drawing of the wire, grooving electrode to permit spiralling of six contact wires, and the coating, is accomplished in one continuous operation.

HALF WAVE RECTIFIER TUBE

Electrons Incorporated, 127 Sussex Ave., Newark 4, N. J., announce a new Half Wave Xenon gas-filled rectifier tube, Type EL 16F. The tube is designed for direct mounting on a panel without socket, thereby eliminating the socket.



EL 16G tubes may be used in rectifier circuits giving up to 96 amp. d.-c. at voltages varying from 24 to 600 v., d.-c., for supplying d.-c. motors, magnets and batteries. Special circuits may be used for powering vibratory motors.

STAINLESS STEEL ELECTRODES

A complete new line of stainless steel electrodes in a full range of grades and diameters has been introduced by the Electric Welding Division of the General Electric Co. The electrodes are available in two types of coatings, one designed for a.-c. or d.-c. use, and the other for reverse polarity d.-c. operation. They can be used in all welding positions.

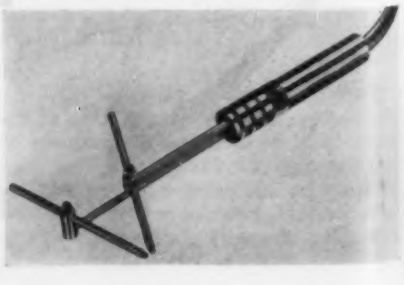
Stability of the arc and deposition characteristics assure flat fillet welds, thereby reducing grinding made necessary by convex fillets as well as the crack sensitivity at times associated with concave fillets. Stable arc characteristics also permit good directional control.

The electrodes are wrapped in 5-lb. rolls with laminated, moisture-resistant paper, and labeled for easy identification. They are furnished in standard packages of 25 lb. in $^1/_{16}$-, $^5/_{64}$- and $^3/_{32}$-in. sizes, and in 50-lb. packages in $^1/_8$-, $^5/_{32}$-, $^3/_{16}$- and $^1/_4$-in. sizes.

ARC TORCH

The Lite-ning Arc Torch, for use with both a.-c. and d.-c. welders, is one of a new line of welding products announced by Cesco Products, Inc. This torch is designed to greatly widen the scope of electric welders permitting them also to be used for jobs that formerly required gas welders. A soft intense heat with no pressure blow or oxides is characteristic of the carbon-arc flame produced by the Lite-ning Arc Torch. It makes possible the welding of aluminum and virtually all ferrous and nonferrous metals as well as brazing, soldering, preheating and hard surfacing. Because there is no pressure blow there is little danger of burn throughs and even thin aluminum sheets can be welded without backing.

The new Lite-ning Arc Torch features a time-saving automatic arc which greatly



Hard-Face Your FORMING DIES with the NEW COLMONOY SPRAYWELD PROCESS

DIES SPRAYWELDED with COLMONOY ALMOST last forever—

It is the unanimous feeling of those who far-face their dies by this method.

The Colmonoy Sprayweld Process units welding and metallizing practices. Colmonoy No. 6 is first sprayed on the die surfaces to be faced. By this method, the exact amount of overlay can be applied smoothly and uniformly. This overlay is then fused to the base metal with an Oxy-Acetylene torch to obtain a fusion bond identical to that obtained when the same alloy in rod form is applied by welding. The final result is a smooth uniform overlay, free from porosity, and requiring very little if any finishing, before being put in service.

The Colmonoy Sprayweld Process may be used for part of almost any size, ranging from large dies, like the one shown in the picture, to small plug gages. About the only limits to the Process is the ingenuity of the user.

The Colmonoy Sprayweld Process may be executed in one of two ways, by

(1) The New Colmonoy Spraywelder, which is used to spray Colmonoy No. 6 in Powdered Form. The Spraywelder is a new powder-spraying unit developed by Wall Colmonoy Corporation, for use with the Sprayweld Process.

(2) Colmonoy Plastic Bonded Rod, which can be used in conjunction with standard wire metallizing equipment.

WRITE FOR ILLUSTRATED LITERATURE

For full information on the Colmonoy Spraywelder Process, or the sensational new Colmonoy "Spraywelder," write to

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Manufactured under Patent No. 1,865,169, owned by The Reid-Avery Company, the patent covering the multiple longitudinal groove feature of this type of electrode.

RACO COMPOSITE TYPE A

THE NEW AND REVOLUTIONARY ELECTRODE FOR AUTOMATIC ARC WELDING

RACO Composite Type A is a heavily coated electrode in coils, providing the same physical results as heavily coated manual electrodes. With RACO Composite Type A, extremely high speeds can be obtained in any position.

It can be used with all standard automatic arc welding heads without alterations or additions.

RACO Composite Type A can be had with any of the following coatings—A.W.S. 6012; A.W.S. 6020; A.W.S. 6030*. This electrode can also be had in three grades of hard surfacing material for building-up—RACO 25 (20-25 Rockwell C), RACO 45 (40-50 Rockwell C) and RACO 55 (50-60 Rockwell C). RACO Composite Type A Electrode is furnished in the following sizes: No. 6 (approx. 1/4"); No. 5 (approx. 7/32"); No. 4 (approx. 3/16"); and No. 3 (approx. 5/32"). Coils are 36 inches I.D., and weigh 150 to 200 pounds net.

The manufacture of RACO Composite Type A Electrode is one continuous operation embodying the following steps: 1) a round wire is drawn to predetermined size; 2) we deep-groove the round wire to a standard shape for all sizes; 3) we then draw and wrap six contact wires around the special shape and extrude coating on same. Result—RACO Composite Type A Electrode, eliminating slitting shielded arc coatings to obtain contact with wire . . . doing away with wrapping shielding materials on wire during operation . . . banishing troublesome recovery of unused melt.

Send for price and delivery information now . . .

*and A. W. S. 7020, 7030, 8020, 8030, 9020, 9030, 10020, 10030.

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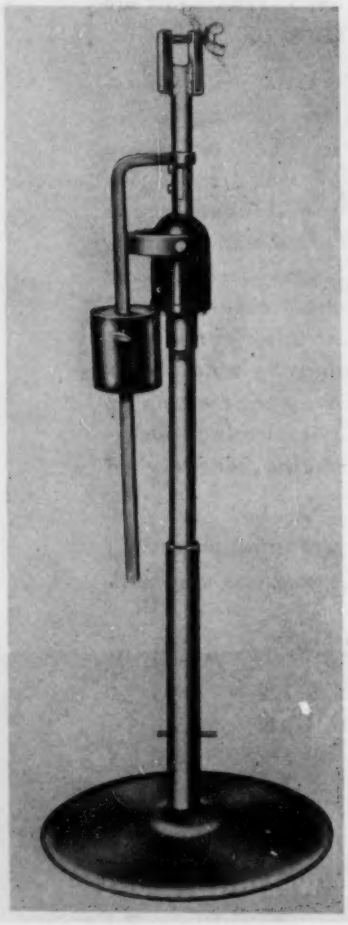
simplifies the welding procedure. New design thumb control permits the operator to maintain instant adjustment of the arc at all times. Two models are available, one for 1/4-in. carbons and one for 3/8-in. carbons. The cost for the Lite-ning Arc Torch is quite low. Complete information may be obtained from Cesco Products, Inc., 30 North LaSalle St., Chicago 2, Ill. Ask for bulletin No. 11.

WORK POSITIONER

A universal work positioner to hold and position many kinds of welding and benchwork quicker and easier for production, assembly, service and maintenance, is in mass production by the Garfield Engineering Corp. of Kansas City, Mo.

The Powrarm M-1 Universal Positioner (for welding) increases efficiency and productivity of worker by permitting him to work with both hands free. Conserves workman's energy by properly positioning work and reduces hazard of injury and damage. Affords ready access to all sides of work. The Powrarm Positioner holds light or heavy work and permits turning 360° at any angle or horizontal or axial planes and 180° on vertical planes. Change position of work quickly and easily by just a twist of the wrist, turning the work to the desired position. A new mechanical principle of pressure applied to a ball and socket joint makes this possible. Powrarms are also produced in both hydraulic and mechanical models for benchwork.



A line of universal attachements available with the Powrarm permit mounting many types of work including welding operations, carburetors, distributors, speedometers, generators, magnetos, radio, chassis, typewriters, airplane cylinder heads, castings, machined parts compressor, adding machines, taxi meters, transmissions, sewing machines, vise work and hundreds of other items.

LOW-TEMPERATURE WELDING RODS

All-State Welding Alloys Co., Inc., 96 West Post Road, White Plains, N. Y., announces the addition of two new nickel-silver welding rods to its line of low-temperature welding and brazing alloys and fluxes. This type of rod has been scarce on the market for some time, but All-State now has large stocks of the two rods on hand and is offering them at prices somewhat below those at which such rods have been offered previously. One of these rods is recommended for production and fabrication of light steel and nickel alloy sections and is suitable for low-temperature welding of steel, stainless steel, copper nickel and nickel; the other is recommended wherever resistance to frictional wear is desired and especially for work on worn or broken parts.

FLASH WELDER FOR ALUMINUM

Shown publicly for the first time by Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, at the Metals Show in Atlantic City, November 18th to 22nd is one of its new storage battery powered flash welders designed and developed for the flash welding of aluminum. It is believed that this is the first time "stored energy" has been applied in production to the problem of flash welding.

Although stored energy was extensively used for resistance welding of aluminum, application was confined to fairly light sections and such operations as spot welding. Reason for the use of stored energy, of course, is the excessive power needed for the welding of aluminum. Stored energy machines have the ability to provide high weld current rates with a considerable lower line load than for a.-c. machines.

Of the three basic types of stored energy machines—magnetic, condenser discharge and battery powered—only the battery type lends itself to flash welding, since flash welding demands a continued current flow rather than a single "shot" of short duration as is provided in the other types.

In addition, another problem presented when flash welding aluminum is the extremely rapid upset required—compared to other materials. This calls for high rates of acceleration and deceleration in the upset mechanism—combined with high upset forces. This problem was met in the Progressive machine through the use of a new type of gearing and clutch.

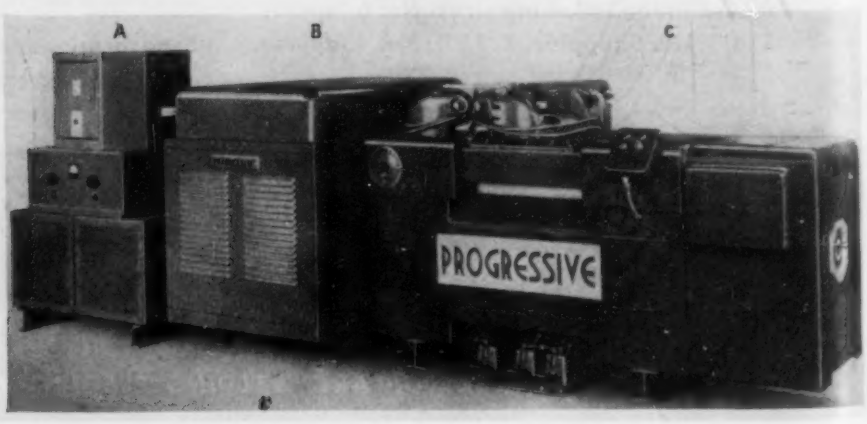
The need for such a machine has been recognized for some time. Their lack has probably retarded as much as anything the wider scale use of extruded aluminum as a fabricating material. Conventional a.-c. machines imposed too heavy a line demand for their use even in metropolitan areas where power supply is adequate for the welding of other materials.

Figure 1 is the new machine flash-welding miter joints of extruded aluminum window sash. To do this on an a.-c. machine would have required a peak demand of at least 500 kva. single-phase, at low power factor. The Progressive battery powered machine does the job with a maximum line demand of only 18 kva. (to keep batteries charged), balanced on 3 phases and at approximately 90% power factor. This is about the same power requirement as for a 10–15 hp., 3-phase motor.

ARC-WELDED CONCRETE POURING MACHINE

Ira J. Kuert, of California, has designed a unique machine that is expected to help a great deal in relieving the housing and building shortage that exists in practically every city in the United States. A saving of over 35% in time in pouring a 40 x 80 standard concrete building is claimed for the machine.

The first unit to be completed was built by the Johnson & Thomas Machine Works, of Los Angeles, Calif., and after many trials has proved to be the answer to a contractor's prayer. It is really unique, in that it mixes and pours concrete at the same time, while traveling under its own power. It completely eliminates the use of transfer equipment, as the mixed con-



Courtesy Hobart Brothers Co.

crete is poured direct from the mixer to the elevator and to the forms. The pouring tower as shown in the accompanying photograph is 45 ft. high, but can be extended to 65 ft. for taller buildings. The tower is erected in sections and need only be extended to the height of the intended building. Another unique feature of this machine is that it will tilt safely 10° to compensate for any grade on which the machine is used.

Arc welding played an important part in the construction of this machine. The four large wheels which carry most of the weight of the tower, were fabricated from 20-in. pipe by arc welding. Each one is 12 in. wide and all four are housed in an arc-welded frame. The entire lower frame assembly is arc welded, as are the corner guests and the smaller wheel mounts. The skip and pouring assembly were also arc welded.

SMALL WELDER

To meet the demand for a low-priced, efficient welder that operates on a 110-v. circuit, the Ergolyte Manufacturing Co., Philadelphia, Pa., announces a new dual-purpose welding kit, the "Ergolyte Junior," now available at hardware, welding supply and automotive supply outlets.

John H. Read, Ergolyte president, states that this standard, insulated, transformer-type machine "has a capacity of 80 amp. and is capable of a great many light welding, soldering and brazing jobs. The Ergolyte Junior is intended for safe, dependable use in hobby shop, machine shop, garage, sheet metal work, for farm repairs or general repairs around homes, and by all welders. It retails for $44.85, complete with accessories and carrying case."

The welder is built to operate satisfactorily on any 110-volt. a.-c. circuit properly wired with 14 BX or larger and fused to 30 amp. It covers the 30–80 amp. range in 4 heat steps. A dual purpose holder doubles as an electrode holder and ground cable for metallic arc welding or as an electric torch for brazing, soldering, or welding of nonferrous metals. "It is simply a small welder," says Mr. Read, "that matches the larger transformer-type machines in construction, design and dependability up to its maximum capacity. It has not been designed as a heavy production welder, but as a repair and maintenance unit."

AUTOMATIC ELECTRODE

With the demonstration of a revolutionary new product of the Hollup Corp., a division of National Cylinder Gas Co., Charles J. Haines, president of National Cylinder, announced a new type automatic electrode which is being called the Shield-O-Matic electrode.

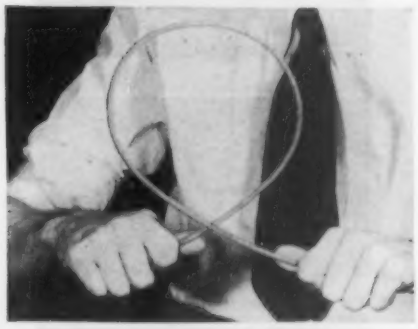


Fig. 3—As Shown in the Above Photo Shield-O-Matic Electrode Has Extreme Flexibility Permitting Bending and Unbending Several Times with No Loss of Flux

As in the manual shielded-arc electrode, the Shield-O-Matic electrode combines all the materials necessary for producing a crucible-enclosed welding arc.

A metallic grid construction that binds a heavy flux coating to the wire core provides for the first time an electrode that will stand extreme flexing and bending without loss of flux and which can be continuously fed into the mechanically maintained arc from a reel. In that the grid extends to the periphery, welding current is conducted through the heavy coating of flux to the inner steel core.

The fin-ridged construction of the electrode core further provides for the conduction of usually high welding currents. Its particular design causes electrode and base metal to melt at a much faster rate than conventionally, thus permitting greater economies in metal fabrication, and greater welding speeds.

FIGURE 1

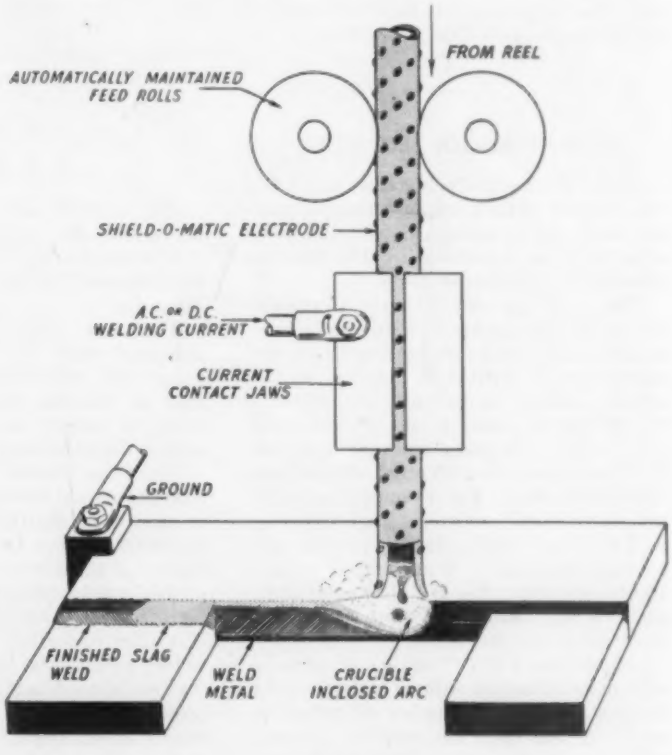


FIGURE 2

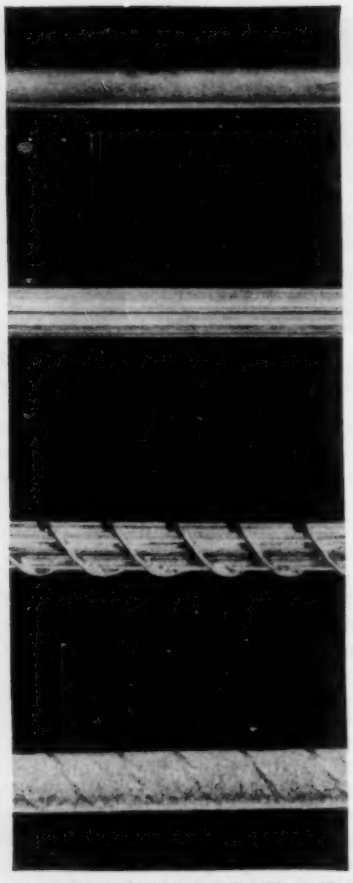


Fig. 4—A Vizualization of the Four Stages in Processing a Shield-O-Matic Electrode. From Top to Bottom: Plain Round Core Rod, Surface of Rod Deeply Grooved, Rod Helically Wound with Fine Wires, and Completed Electrode with Heavy Coating of Flux

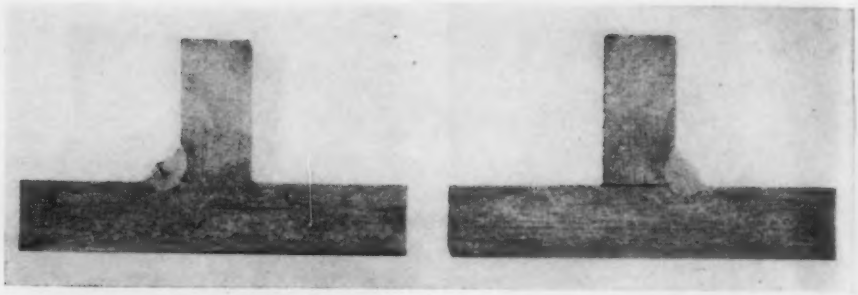
Welds are exceptionally uniform due to the unique construction of the Shield-O-Matic electrode by which fluxing agents and the metallic parts of the electrode are combined in a single product to produce a highly stable arc within a crucible.

LOW-HYDROGEN ELECTRODE

A new electrode which greatly simplifies the welding of high sulphur, free-machining steel and of certain high-tensile, low-alloy steels is announced by The Lincoln Electric Co., Cleveland, Ohio.

The new Lincoln Electric electrode, known as "Shield-Arc LH-70," has a low-hydrogen, low-moisture coating and is designed for use with d.-c. polarity, as the welded tensile properties are 70,000–80,000 tensile strength and elongation is 25 to 30%. Welding currents used are high in comparison with other all-position-type electrodes. For example, approximately the same current is used with $^{5}/_{32}$-in. LH-70 as with $^{3}/_{16}$-in. size in other all-position electrodes. The range is $^{1}/_{8}$ in., 100 to 135 amp.; $^{5}/_{32}$ in., 140 to 190 amp. and $^{3}/_{16}$ in., 180 to 250 amp. A rather short arc is recommended.

"Shield-Arc LH-70" makes possible a weld in less time, according to The Lincoln Electric Co., on a number of types of steel and will open the way for a much wider use of these steels than heretofore.



The Two Cross-Section Samples at Top Are High-Carbon Steel. The One at Left, Welded with the Present Mild Steel Coated Electrode, Shows a Crack, Which Frequently Occurs Under These Conditions. Sample at Right Has Been Welded with "Shield-Arc LH-70" Electrode and Is Free from Cracks

Preheating of high-tensile, low-alloy steels can now be eliminated or largely reduced; welds of exceptional toughness can be made on high-carbon and other steels which tend to show underbead cracking when welded with the usual type of electrodes; welding high-silicon electrical sheet steel is highly practicable with the new electrode and high sulphur steels can be welded as readily as low sulphur mild steel.

An especially interesting application for "Shield-Arc LH-70" electrodes is seen in the arc welding of materials which have to be enameled. Where it was formerly necessary to heat treat the vessels after welding to drive out the hydrogen in order that the enamel would not bubble and peal, enameling may now be done without heat treating. The vast household appliance industry is one of several which will benefit from this development.

In using the new electrode, vertical welds are made from the bottom up. Overhead welds may be made with a narrow lateral weave. The $^{1}/_{8}$-in. and $^{5}/_{32}$-in. sizes are suitable for vertical and overhead welding and on large welds in thick plate, the $^{3}/_{16}$-in. size may be used for vertical and overhead welds.

The electrode comes packed in 50-lb. containers, sizes $^{1}/_{8}$, $^{5}/_{32}$ and $^{3}/_{16}$ in. in diameter by 14 in. in length.

A.-C. WELDER

The Lincoln Electric Co., Cleveland, announces the new "Fleet-Arc" A.-C. welder which is said to have many features not possessed by conventional a.-c. welding units.

The new "Fleet-Arc" A.-C. welder, equipped with the "Arc Booster," surpasses the conventional a.-c. welders in ease of welding, depth of penetration, range of output, economy of operation, safety, dependability and service life.

The "Arc Booster" augments the current the instant the arc is struck. The arc is started automatically the moment the electrode touches the work. This added feature of the new welder has been accomplished safely without the use of special high frequency devices or higher voltage.

A selector switch on the front of the welder governs the amount of booster current to be used in striking the arc. This provides a complete range of striking intensity to suit requirements in the welding of thin sheets or heavy plates, making of tack welds, or in the use of various types and sizes of electrodes.

The "Arc Booster" enables the operator to achieve the maximum depth of penetration in every job, and has the added facility of attaining the maximum depth at the beginning of the weld.

Current control, continuous and self-adjusting, is provided by the rotating reactor control, which affords fast setting throughout the exceptionally wide range of the welder. The operation of current control is fast and involves the simple act of turning a hand wheel which requires a minimum number of turns to cover the range. The amperage is indicated on a calibrated dial on the face of the welder, placed in a weatherproof and readily visible position on the face of the unit.

Thermostatic control, which opens the magnetic starter when overloaded provides a high degree of self-protection for the operator, permitting sustained welding at high current values and use under abnormal conditions with complete protection against damages resulting from overheating.

A higher power factor and a reduction of condenser requirements and less shock to the operator has been gained through the

50
YEARS OF PROGRESS
This new year of 1947 marks the completion of a half-century of devotion to the design, production, improvement and application of X-ray and other electron tubes. Pioneers fifty years ago, we are still pioneering, and in that earnest spirit pledge for the years to come still greater achievements in the electron art, increasing and broadening its service to the Public Health, to Industry, and to Communications.
•
MACHLETT LABORATORIES, INC., SPRINGDALE, CONNECTICUT

use of the "Fleet-Arc's" lower open-circuit voltage. In reducing the amount of condensers required in comparison to the usual a.-c. welders, the idle input current has been decreased considerably.

The "Fleet-Arc" A.-C. welder, manufactured in 200-, 300- and 500-amperage range, has both frame and housing of all-welded construction to assure maximum strength and durability.

HIGHER SPEED AUTOMATIC WELDER

A new development in automatic multi-spot resistance welding machines, said to be even faster in operation than "Ultra-Speed" machines, has been developed and announced by Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.

In general, machines embodying the "Progress-O-Matic" principle may be classified as high-air-pressure operated and controlled automatic multiple spot welders.

In addition to its high speed of operation, an outstanding advantage of the machine is that the various welding guns can weld different thicknesses of metal, requiring variable welding times, heats and speeds. The manner in which this is accomplished is as follows.

Controlling the actuation of the individual spot welds by different guns is an air-driven "Progress-O-Matic" unit. It is an air driven unit for controlling the sequencing of the entire machine. This includes application of welding pressure to timing of welds, and controlling amount of welding current heat for each individual gun.

Basic components of this unit are:

- A housing having sixty ports, one each for a possible maximum of sixty guns.
- A rotating disk which uncovers the various ports in sequence.
- A "Geneva" drive to this disk which creates a dwell of the disk at each port.
- An air motor which drives the disk through the Geneva drive.
- A drum direct connected to the disk. On this drum are 8 cams. Four of these control air flow to the air motor (to vary air motor speed). The other four cams operate switches to select the "heat" desired for each weld.
- Two breakers, synchronized with the indexing disk. Their function is to initiate and stop firing of the tube contactor.

As the rotating, or "indexing" (by virtue of the Geneva drive), disk uncovers the first port, high pressure air is admitted to the corresponding gun circuit, operating the circuit-closing cylinder on gun No. 1. At the same time the heat-control cams on the drum select the proper heat-control for that gun and the speed control cams adjust the speed of the air motor in accordance with the desired weld cycle for gun No. 1. The two breakers now close, initiating the welding current to gun No. 1. At the proper instant, one of the breakers opens, interrupting the welding current.

The disk now indexes, closing port No. 1. The circuit-closing cylinder retracts, opening the circuit for that gun. The disk passes on at high speed to uncover port No. 2 and the same cycle is repeated for gun No. 2, etc.

Reasons for the use of multiple cams and breakers are to permit a wide range of adjustments. Thus the four speed-control cams control four air valves. These enable a wide speed variation of the air motor according to the length of dwell desired (weld time, etc., required). Again, the four heat-control cams permit a broad selection (from 0 to 100%) of "heat," by means of transformer taps, or phase-shift heat control, if desired.

The breakers have 180° cams and rotate a total of 360° for each position of the disk. Use of two breakers, connected in series, permits full range of stepless adjustment for weld time.

Cams, incidentally are made up in segments, permitting easy change to alter welding conditions for any one gun, if desired.

Current is supplied by a single water cooled transformer to all the guns. The electrical circuit is close-coupled in "Progress-O-Matic" machines so that there is very little reactance in the circuit and electrical efficiency is high. This feature permits the maximum use of the welding transformer capacity for actual welding.

The high air pressure required to operate the "Progress-O-Matic" at high speeds is provided by a compressor of the Ingersoll-Rand superimposed piston type, built by the Power Plus Co., of Detroit. The compressor is driven through a 5-hp. a.-c. motor and develops up to 1000 psi. air pressure.

NONSYNCHRONOUS RESISTANCE WELDING CONTROLS

A new line of nonsynchronous electronic resistance welding control combinations has been announced by the Control Division of the General Electric Co. The new line, designed to meet the new N.E.M.A. standards for resistance welding controls, includes combinations of ignitron contactors and sequence-weld timers, with or without electronic heat control, all mounted in a single cabinet.

Although designed for mounting on the right-hand side of the welding machine, the control cabinet can be placed on the floor alongside the machine or mounted on a wall or balcony. When mounted on the welder it is necessary only to connect air, water and power for a complete installation, as all interconnections between individual controls are made at the factory. The control station is within easy reach of the operator when the unit is mounted on the welder. By adding extension cable the control station may be mounted at the machine while the main control panel is located remotely.

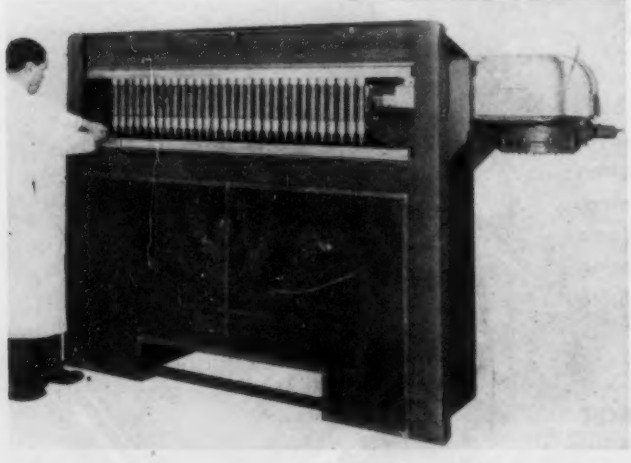
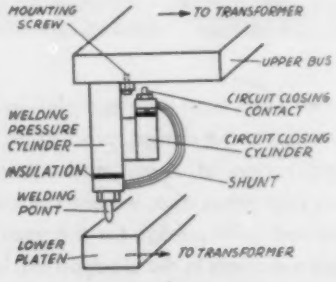


Fig. 1

Demonstrating the new "Progress-O-Matic" principle of high-speed automatic spot welding is this machine built by Progressive Welder for demonstration at the Metals Show, Nov. 18th to 22nd. Outstanding features of the new machine are higher speed automatic welding, ability to weld different thickness of metal with different guns, combined with unusual simplicity both in operation and in construction. Operation is through high air pressure (up to 1000 psi.).



Sketch A (Above)

Sketch B (Right)

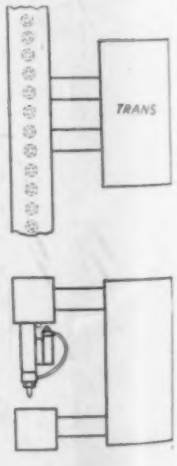
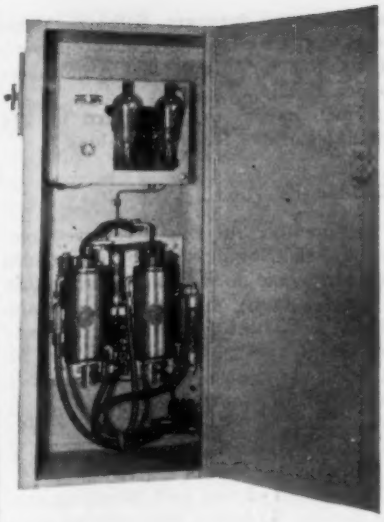


Fig. 2

Sketch A. Detail of the manner in which each gun is mounted in the machine with a single screw. The cylinder on the right of the gun closes the contact for that gun with the upper bus bar just before the welding current "comes on" for that gun.

Sketch B. Sketch showing the simple electrical circuit of the new Progressive Welder Co. "Progress-O-Matic." Note the remarkably short low-reactance welding loop, resulting in high electrical efficiency and better welding conditions.



G-E Resistance Welding Control Access Door Open. Right-Side View Showing Tubes

The individual panels in the new combinations are of the same design as those now in use. The ignitron contactors offer high-speed operation and flexibility. The sequence-weld timers give accuracy of timing regardless of normal time voltage variations, because voltage-regulation tubes are used in the timing circuit. The use of industrial-type relays, cabled wiring and plug-in timing panel and accessories simplifies servicing and increases flexibility. Electronic heat control provides smooth stepless adjustment of the welding current.

The timing, or front, portion of the sequence-weld timer can be removed for servicing in a few seconds. The back panel of the timer, control station or electronic heat control panel can be quickly removed for replacement.

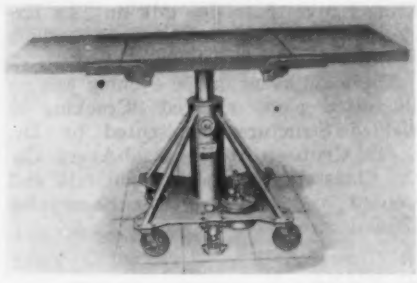
REMOVABLE EXTENSIONS FOR HYDRAULIC ELEVATING TABLE

Removable table top extensions are the latest optional extra offered by LYON-Raymond Corp. for their Hydraulic Elevating Table.

These extensions were designed to more particularly adapt the table to strip and sheet feeding operations. In cases where long strip or sheet stock must be fed to presses, the addition of the extensions provides firm support for a length of 72 in.

It is necessary only to lift an extension by the end to disengage it from the attachment pins. The extensions may be ordered with a table or purchased afterward for installation on a table already in use.

A modified Hydraulic Elevating Table can be furnished for sheet feeding where a support longer than 72 in. is required. LYON-Raymond Corp., 3064 Madison St., Greene, N. Y.



NO "TIRING" WORK THIS A 60% weight saving has been acheived in these 2S aluminum truck tire flap curing rims over the 30 pound steel rims they replace. Fabricated by The American Welding & Manufacturing Company, Warren, Ohio the rims are rolled from $^{3}/_{16}$ in. flat aluminum strip and flash butt resistance welded.

SECTION ACTIVITIES

BOSTON

The program for the December 2nd meeting of this Section consisted of dinner, movies and a speaker. The films shown were "A Harbor Goes to France" giving the history of "Operation Mulberry," the huge prefabricated twin harbor used by the Allies in the invasion of Europe, and "Time and Tide," which emphasizes the skill and precision required in raising sunken ships which obstruct harbors or channels.

C. C. Hand, Pittsburgh District Engineer, Stoody Co., was the speaker of the evening. The topic was "Microstructure of Hard-Facing Alloys" and covered classification of such alloys according to microstructure. Slides were used to illustrate the paper. Discussion after presentation of the paper was interesting and lengthy, with many questions being asked.

CHATTANOOGA

The Chattanooga Section met for their second meeting of the year at the Chattanooga Golf and Country Club with 25 persons attending. The program was arranged by R. E. Lorentz, Program Committee Chairman. Walter J. Brooking, Dean of LeTourneau Institute, Longview, Tex., spoke on the subject of "Arc Welding Engineering and Control," illustrated with movies and slides.

This program was accepted by all who attended as one of the finest yet, with the speaker giving timely information regarding practical welding.

Considerable round table discussion was held after the meeting *re* the National Metals Congress in Atlantic City.

CLEVELAND

At the December meeting of the Cleveland Section, a plant inspection trip of The Lincoln Electric Co., was held.

Those attending the inspection trip were not only interested in the manufacturing processes for the a.-c. and d.-c. welding machines, but were also interested in the remarkable industrial relations policy which has attracted national attention.

A dinner was held in the company cafeteria at which James F. Lincoln, president of the company, spoke on "The Future of Arc Welding" and H. F. Kneen, vice-president in charge of production, described the philosophy of manufacturing at the company and pointed out to the members present the interesting phases of the manufacturing operations which they saw later on their inspection tour.

DAYTON

R. W. Emerson, metallurgist of The Pittsburgh Piping and Equipment Co., was the guest speaker at the November 13th meeting. The title of his address was "Metallurgical Problems in the Welding of Alloy Steel Piping for High Temperature–High Pressure Service."

DENVER

October 15th meeting was held in the Capitol Life Insurance Auditorium. Two pictures were shown as follows: "Die Casting" shown through the courtesy of the New Jersey Zinc Co., and "Unfinished

Rainbows," shown through the courtesy of the Aluminum Co. of America.

Howard Simms of Black, Sivalls and Bryson Co., Oklahoma City, gave a very interesting and informative talk on Automatic Welding, with particular reference to its application to welding of pressure vessels.

The November meeting was held on the 12th in the Auditorium of the Barnes School of Business. Speaker of the evening was C. B. Herrick, Editor of *Industry and Welding*, who gave a very interesting talk on "Let's Get Welducated."

A motion picture entitled "Meehanite Iron" was shown through the courtesy of the General Iron Works, Denver.

DETROIT AND SAGINAW VALLEY DIVISION

The following program was presented before the Detroit Section on Friday, November 8th, and the Saginaw Valley Division on Thursday, November 7th.

"This is Resistance Welding," a technicolor movie, was shown through the courtesy of the General Electric Co.

"Projection Welding, *et al.*," by G. N. Sieger, president, S-M-S Corp. Mr. Sieger, in his own, inimitable way, proved that he is as conversant with arc and oxy-acetylene welding as he is with resistance welding.

The fourth meeting of the season was held on Friday, December 13th, in Detroit and Thursday, December 12th, in the Saginaw Valley Division. Program was as follows. Thomas J. Crawford, consulting engineer, presented a review, description and discussion of the principal commercial methods and materials used for repair and production welding of cast iron, with particular reference to the electrodes most recently developed for producing machinable welds.

A. F. Witt and H. O. T. Ridlon of the National Cylinder Gas Co., spoke on the subject, "Gas Cutting Cast Iron."

KANSAS CITY

Clayton B. Herrick, Editor of *Industry and Welding*, was the guest speaker at the November 14th meeting held at the K. C. Power and Light Building. Mr. Herrick's talk on "Let's Get Welducated" was very well received. Mr. Herrick was a charter member of the Kansas City Section and everyone enjoyed discussing progress made in welding since the charter was granted.

LOUISVILLE

The regular monthly meeting was held on Tuesday, November 26th, at the Kentucky Hotel. Dinner preceded the meeting.

Thomas J. Crawford, consulting engineer for C. E. Phillips & Co. in the welding field, covered the various aspects of Arc Welding of Cast Iron. Various types of rods were discussed and the considerations governing the choice of rod for a particular job were outlined.

A movie was shown through the courtesy of the Industrial Equipment Co.

LONG BEACH

The Long Beach, Calif., Section held its November meeting on the 22nd at the Masonic Temple. Dinner at Allen's Shore Dinners preceded the regular meeting. Arthur R. Wynn, the dinner speaker, spoke on the AMERICAN WELDING SOCIETY.

Tom Piper of Northrup Aviation was the guest speaker. Mr. Piper spoke on The 100% Welded Airplane. His development of the Heliarc in the welding of airplanes was a new wonder to quite a few members present and the extensive use of it in the aircraft industry.

MARYLAND

The November meeting of this Section was held on the 15th at the Baltimore Engineers' Club. The meeting was preceded by a dinner after which G. C. Klingel gave the coffee talk on "An Exploration Trip to the Bahamas," which was illustrated with slides.

The main event of the evening was an illustrated paper entitled "Cracking in Welded Structures" presented by Dr. G. E. Claussen of the Reid-Avery Co. Dr. Claussen gave an excellent talk and aroused considerable after-the-meeting discussion.

MICHIANA

The November 15th meeting was held at the Bendix American Legion Post. A. E. Hackett, Field Engineer of the Progressive Welder Co., spoke on the "History of Resistance Welding." A film on Resistance Welding was shown through the courtesy of the General Electric Co.

MILWAUKEE

Regular meeting was held on Friday, November 22nd, at the Ambassador Hotel. After-dinner program consisted of a sound color film entitled "Headwork" shown through the courtesy of the Lukens Steel Co. This film showed the manufacture of large heads for tank and pressure vessels.

The main speaker was Lawrence Jacobsmeyer, general manager, Salkover Metal Processing, Chicago. Mr. Jacobsmeyer's subject was on "Controlled Atmosphere Copper Brazing."

A membership drive resulted in 214 new applications for memberships.

NEW JERSEY

The members of the Executive Committee of the New Jersey Section attended a garden picnic on Saturday, August 3rd, at the new home of J. D. Dyer in Plainfield, N. J. Those attending were Mr. and Mrs. R. M. Wilson, Mr. and Mrs. P. M. Mattern, Mr. and Mrs. T. B. Smith, Mr. and Mrs. A. B. Kime, Mr. and Mrs. H. R. Steffins, Mr. and Mrs. G. W. Nigh, Mr. and Mrs. R. Powell, Mr. and Mrs. R. T. Pursell and Mr. W. H. Hart.

The garden setting with blooming summer flowers, fish pond, vine-covered patio, with very comfortable lounge furniture, offset by two large fieldstone fireplaces, provided an ideal atmosphere for the occasion. A continuous picnic lunch was served.

A horseshoe pitching contest featured the activities of the day, with Mr. Steffins and W. H. Hart emerging as the championship team. All those attending enjoyed a very splendid afternoon of relaxation.

Dr. Wendell F. Hess, Head of the Welding Laboratory, R.P.I., was the guest speaker at the October 15th meeting held in the Essex House, Newark. Dr. Hess's topic "Metallurgy of Welding Processes," outlined the various metallurgical problems encountered in welding. Among other things, Dr. Hess explained the cause and cures of carbide precipitation in the welding of the austenitic stainless steels and the cause and cures of oxide embrittlement in the welding of copper.

Arthur J. Raymo, Works Manufacturing Engineer, The Baldwin Locomotive Works, Philadelphia, spoke on the subject "Arc Welding as Applied to the Construction of Rail Transportation Equipment," at the November 12th meeting held in Essex House. Mr. Raymo opened his talk by outlining some very interesting statistics regarding periods of the various types of fuels and locomotives. Mr. Raymo covered the subject very thoroughly and the manner in which the paper was presented was excellent.

New Jersey Section Garden Picnic

NEW ORLEANS

Leslie M. Dalcher, Technical Secretary of the A.W.S., was the speaker at the November 8th dinner meeting held at the St. Charles Hotel. Mr. Dalcher's subject "Relations with Central Office of A.W.S." was very well received and highly recommended for other Sections.

NEW YORK

The important field of pressure vessel fabrication was the subject of the November 13th meeting. Members of the Metropolitan Section of the A.S.M.E. joined with the New York Section of the A.W.S. for this meeting. H. R. Kessler, Chairman of the A.S.M.E. Metropolitan Section was Technical Chairman of the meeting.

Taking as his topic "Welding of Pressure Vessels for Low and High Temperature Service," R. E. Lorentz, Jr., in charge of welding metallurgy for the Combustion Engineering Co., Inc., at Chattanooga, Tenn., discussed various problems in this important fabrication field. He described recent advances in steel welding procedures in detail and discussed general fabrication problems. The code requirements for this type of fabrication and the history of the development of safety requirements under the sponsorship of the A.S.M.E. were also covered.

NORTHWEST

Through the courtesy of Bob Stoddard, assistant chief engineer of the American Hoist & Derrick Co., members of the Northwest Section had the rare opportunity of visiting the plant of the American Hoist & Derrick Co., St. Paul, Minn., on Wednesday, November 20th, and observed the welding and cutting operations of this company. Guides explained the methods of operation and answered all questions.

A steak dinner was served in the company's cafeteria.

The December meeting was held on the 5th in the Lodge Room of the Covered Wagon, Minneapolis. C. M. Underwood, Manager, Weldment Dept., Northern Ordnance, Inc., Minneapolis, spoke on "Modern Welding Processes." Mr. Underwood has spoken on this subject at several other A.W.S. Sections, and from his wide experience in the various branches of the art and science of welding, he is recognized as an authority on the subject.

PEORIA

J. H. Cooper, Chief Sales Engineer, Taylor-Winfield Corp., spoke before a joint meeting of the Peoria Section of the A.W.S. and the Peoria Chapter of the American Society for Metals, on November 11th. Mr. Cooper's illustrated talk was on "Unusual Resistance Welding Applications" and was very well received by the 85 members and guests present. A film "This Is Resistance Welding" was also shown.

PHILADELPHIA

The regular November meeting of the Philadelphia Section was replaced by the National Metals Congress and Exposition held in Atlantic City, N. J., the week of November 18th.

The December meeting was held on the 6th at the Engineers' Club on Friday, December 6th. Dinner preceded the regular meeting. A sound movie "Brazing Aluminum" was shown through the courtesy of the Aluminum Co. of America. A. M. Setapen of Handy and Harman, Inc., spoke on the subject of Brazing. Mr. Setapen is an expert in this field and through his wide background of experience he presented valuable information on the subject.

PITTSBURGH

The regular monthly meeting of this Section was held on November 27th in the Mellon Institute of Industrial Research Building. A. G. Bissell of the Bureau of Ships, U. S. Navy, discussed the subject "Welding in Ship Construction." Mr. Bissell's talk was illustrated with slides and films.

PUGET SOUND

The Puget Sound Section held its November meeting on the 19th at the Engineers' Club, Seattle. "Unionmelt Welding" was the subject of the meeting. W. R. Clark, Manager, The Linde Air Products Co., Seattle, presented a paper thoroughly covering this important phase of welding. Several slides of film pertinent to the process were shown. J. W. Dickinson, Process Service Supervisor, The Linde Air Products Co., Seattle, acted as discussion leader.

ROCHESTER

This Section met at the University of Rochester's Engineering Building on December 5th for its third meeting of the current season. Messrs. Smith and Barnett of the Metal and Thermit Corp. presented an address and showed a movie. A very good color movie on applications of thermit welding in the shipbuilding and railroad industries was shown. The film had been prepared under Mr. Smith's supervision and he conducted a short discussion on thermit welding at the conclusion of the movie.

Mr. Barnett, principal speaker of the evening, then gave a very excellent presentation of "Taking Inventory of Welding Costs." He emphasized the advisability of giving much attention to labor-saving devices and general conveniences of the welder.

SAN FRANCISCO

The regular monthly meeting was held on November 25th at the Engineers' Club. A. P. Johnston, of Los Angeles, gave a demonstration of Alloy Electrode Coatings. A sound motion picture "The Atom Strikes" was also shown.

SYRACUSE

Dr. W. G. Theisinger, of the Lukens Steel Co., was the guest speaker at the November 13th meeting held at the Syracuse Hotel. Dr. Theisinger's subject "Economical Selection of Metals for Welding" has been published in THE WELDING JOURNAL. A sound picture "Manufacture of Steel" was shown through the courtesy of the Lukens Steel Co.

The Section also reports the erection of the Electronics Park Buildings by the General Electric Co., which were welded throughout.

WASHINGTON

The Washington Section held its second meeting of the season on November 29th. Carl M. Underwood, Manager, Welding Dept., Northern Ordnance, Inc., Minneapolis, was the speaker. His topic was "Mass Production of Heavy Weldments During the War." A large audience, including many of Mr. Underwood's former associates in Washington, attended.

Mr. Underwood's talk was chiefly of importance in that it brought out the high quality and efficiency possible in a new plant designed specifically to make use of welding in producing precision equipment.

WICHITA

The regular meeting was held on Monday, November 11th, at the Broadview Hotel. The Section was fortunate in having for its speaker, Clayton B. Herrick, Editor of *Industry and Welding*. Mr. Herrick's subject "Let's Get Welducated," was very well received and thoroughly enjoyed by the 35 members and guests present.

The speaker brought to the attention of those present the advancements in welding processes and technique brought about by production and design necessities. The meeting was concluded by a general question-and-answer period.

WORCESTER

Organization meeting of this Section in Worcester, Mass., was held on November 14th in the Cafeteria of the Worcester Boys Trade School. The following officers and directors of the Section were elected.

Chairman, John F. Sloan, Supt., Haynes Welding Co.; *Secretary*, Charles H. E. Coster, Worcester Boys Trade School; *Vice-Chairman*, James L. Forand, Welding Foreman, Pullman Standard Car Mfg. Co.; *Directors*, Francis Harvey, Wayne V. Green, C. Myron Burnett, Robert Jamieson, Gustaf A. Rehnberg and Ernest N. Adams.

CANADIAN

The second meeting of the 1946–47 Season of the Montreal Chapter of the Canadian Welding Society, was held on November 18th in The Engineering Building, McGill University. "Expansion and Contraction of Metals in Welding," was presented in French by M. Yvon Gratton of the Veterans Rehabilitation Centre.

The December meeting of the Toronto Chapter was held on the 4th at Malloney's Art Galleries. R. J. Anderson, manager of the Unionmelt and Heliarc Depts., Dominion Oxygen Co. Ltd., spoke on the subject "Heliarc Welding."

ABSTRACTS OF CURRENT WELDING PATENTS

Prepared by V. L. Oldham

Printed copies of patents may be obtained for 25¢ from the Commissioner of Patents, Washington, D. C.

2,410,164—ELECTRODE HOLDER—Honel A. Jackson, inventor, Detroit, Mich. (5 Claims)

This patented electrode holder has an electrically conducting head and an insulating cover around the head. The insulating cover is secured to the head by a pin made of insulating material.

2,410,256—WELDERS' HELMET—Marshall N. Anderson and Melvin H. Sellstrom, inventors, Chicago, Ill., assignors to Sellstrom Manufacturing Company. (3 Claims)

The helmet disclosed by this patent has a headband that pivotally mounts a face mask and an eye shield. The face mask and eye shield are coupled together so that the eye shield is placed in shielding position when the face mask in is nonshielding position and vice versa.

2,410,306—WELDING SHIELD OR THE LIKE—Raymond A. Romberg, inventor, Orange, Conn. (1 Claim)

Romberg's shield is portable, frustoconical and rigid, but it has a flexible skirt secured to its base portion. The shield has an opening in its side that communicates with openings in the top and bottom of the shield.

2,410,461—SUBAQUEOUS ARC-WELDING AND CUTTING ELECTRODE—Bela Ronay, inventor, Annapolis, Md. (7 Claims)

Ronay's novel electrode has an open seam tubular core enclosed in and sealed along its length by a moisture impervious insoluble coating which is disintegrated slower than the electrode to insure formation of a crater at the end of the electrode. Gas may be fed through the bore of the electrode.

2,410,464—BONDING METHOD—Lawrence B. Scott, inventor, Columbus, Ohio. (5 Claims)

This method relates to bonding metal fractures and includes grooving a piece of metal along its fracture and removing additional metal along the grooved metal to form spaced projections at the bottom of the groove and increase the area of the fractured surface. Then openings are formed below the groove for passage of heat and bonding metal is deposited in the fracture.

2,410,766—APPARATUS FOR FABRICATING WELDED WIRE FABRIC—Theodore Harry Wickwire, Jr., inventor, Ardmore, Pa., assignor to Theodore Harry Wickwire, Jr., Sophie H. Wickwire, Roma A. Wickwire and Hedge Wickwire, doing business as a copartnership under the name of Theowick Company. (11 Claims)

The patented apparatus has a plurality of pairs of welding wheels adapted to receive a wire strand between the wheels of each pair, with the wheels being in alignment at 90° to the strands. Transverse wires are positioned on the strands at an angle other than 90° to them so that the transverse wire is between wheels of different pairs at different times.

2,410,850—PROTECTIVE COVERING FOR WELDING RODS—Rene D. Wasserman, inventor, New York, N. Y. (3 Claims)

Wasserman's patented welding or brazing rod has a corrosion-resistant metal film of less than 0.05 of an inch on it and made from a metal having a melting point of below 800° F. The film is made from successive strata of metals from the group of bismuth, tin, zinc, cadmium, lead and antimony.

2,411,224—WELDER'S HELMET—Joe O'Reilly, inventor, Tacoma, Wash., assignor to Welding Service Sales, Inc. (4 Claims)

The patent relates to a special clip for securing a shield window in place in a welder's helmet.

2,411,329—HOLDER FOR WELDING RODS—Charles Mankouski, inventor, Portland, Ore. (1 Claim)

This electrode holder has a chuck and spring collet for positioning the end of an electrode.

2,411,439—BRAZING, SOLDERING, OR THE LIKE PROCESS—George Herbert Lee, inventor, Bristol, England, assignor to The Bristol Aeroplane Company. (1 Claim)

This process relates to securing a plurality of cooling fins to the base of a junkhead of an internal combustion engine and the base to a tubular wall of the head. The fins and base are assembled, flux is introduced into the assembly which is heated and rotated, and brazing material is added to the assembly. The heating is continued as the brazing material is introduced, and then the assembly is cooled and rotated at a controlled speed as it is being cooled to regulate the form of the brazed joint produced.

2,411,465—GAS-ARC HAND TORCH—George Richardson and John Horlick, inventors, Lynn Mass., assignors to General Electric Company. (4 Claims)

The patented gas-arc hand torch includes a handle, an electrode holder, a nozzle adapted to discharge gas onto the arcing terminal of an electrode supported in the holder, and a gas pipe comprising part of the torch but being spaced from the nozzle and the holder to permit work to be inserted therebetween and being provided with a discharge nozzle located in front of the arcing terminal of the electrode but spaced therefrom. Thus the torch can supply gas to both surfaces of an article being worked upon and flow of gas and arc current are controlled from the handle.

List of New Members

November 1 to November 30, 1946

BIRMINGHAM

Walter, Clement S. (C), 2915 Canterbury Rd., Birmingham 9, Ala.

BRIDGEPORT

Miller, Ransom G., III (B), 30 Ridge Circle, Stratford, Conn.
Pulver, Royal F. (C), 760 S. Main St., Seymour, Conn.
Young, Austin A. (B), 185 Treadwell St., Hamden, Conn.

CANADA

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CHATTANOOGA

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CHICAGO

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Biesmann, Paul F. (C), 8647 Ferris Ave., Morton Grove, Ill.
Dawson W. N. (C), Hollup Corp., 4700 W. 19th St., Chicago, Ill.
Johnson, Chester H. (C), 1442 Cuyler Ave., Chicago 13, Ill.
Mickalek, Charles A. (C), 1901 Highland Ave., Berwyn, Ill.
Mittelstadt, Roy L. (B), Paramount Textile Machinery Co., 197 S. West Ave., Kankakee, Ill.
Navis, Gail H. (C), 5549 So. Neenah Ave., Chicago, Ill.

CINCINNATI

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CLEVELAND

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DETROIT

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HARTFORD

Brady, Thomas W. (B), Westinghouse Electric Corp., 119 Ann St., Hartford, Conn.
Sykes, Lewis D. (B), 11 Hickory Lane, W. Hartford, Conn.

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LEHIGH VALLEY

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MARYLAND

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Bauerlein, Carl C. (C), Trent Engrg. Co., East Troy, Wis.
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Becker, Edward A., Jr. (C), 2750 N. 37th St., Milwaukee, Wis.
Behrens, Werner C. (C), 1307 S. 93rd St., West Allis 14, Wis.
Best, Lon B. (C), 341 E. Lakeview Ave., Milwaukee, Wis.
Bethke, Nilus (C), 10431 W. Courtland, Milwaukee, Wis.
Black, Glenn R. (C), Wisconsin Electric Power Co., 231 W. Michigan St., Milwaukee 1, Wis.
Blake, H. Dudley (C), Welder Sales, Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Blotz, William (C), Dings Magnetic Separator Co., 500 S. 93rd St., Milwaukee, Wis.
Bogie, Robert (C), 2767 S. Ellen St., Milwaukee, Wis.
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Dugan, Kevin J. (C), 7636 Rogers Ave., Wauwatosa, Wis.
Dyble, Wm. J. (C), 3326 S. 63rd St., Milwaukee 14, Wis.
Evert, Floyd M. (C), Heil Co., 401 High St., Pewaukee, Wis.
Felder, Raymond (C), 6103 N. 76th St., Milwaukee 9, Wis.
Fick, Oscar (C), 3214 N. 6th St., Milwaukee, Wis.
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Hyde, Ed E. (B), 2nd & Brooks, San Francisco, Calif.
Larson, Raymond A. (C), 37 Hillcrest, Box 487, Benecia, Calif.

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TULSA

Holmberg, M. E. (B), Phillips Petroleum Co., Bartlesville, Okla.

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Robbins, Harold W. (C), 5806 First Place S., Arlington, Va.
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WESTERN MICH.

Bakeman, Edwin (B), 810 James St., Belding, Mich.
Harris, Lemuel J. (B), 400 Van Raolte Ave., Holland, Mich.
Holcomb, O. B. (B), 76 W. Gaguac St., Battle Creek, Mich.

WESTERN NEW YORK

Jesionowski, Richard A. (B), 66 West Doughty St., Dunkirk, N. Y.
Zeis, George W. (C), R. C. Neal Co., Inc., 76 Pearl St., Buffalo, N. Y.

WORCESTER

Allen, Charles A. (C), G. F. Blake, Inc., 198 Mechanic St., Worcester, Mass.
Armour, W. W. (B), Armour's Pattern Shop Co., 324 Grove St., Worcester, Mass.
Boorky, Harry E. (B), Mass. Steel Treating Corp., 118 Harding St., Worcester 4, Mass.

(*Continued on page 96*)

"Sure we've got Wrought Iron Welding Fittings!"

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Tube-Turn wrought iron welding fittings are a standard part of the line as well as stainless steel, copper, aluminum, monel metal, inconel, nickel, carbon moly, chrome moly, brass. Tube-Turn welding fittings in these metals are available in all necessary weights, in a wide range of analyses, types, and sizes. The complete line of Tube-Turn welding fittings and flanges covers more than 4,000 items. Many of these are in stock with foresighted Tube Turns distributors, in every strategic industrial center, who built up a supply when this was still readily possible.

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Members Reclassified

During Month of November

LOS ANGELES

Babbitt, C. A. (from C to B), 5717 Santa Fe Ave., Vernon, Calif.

NEW JERSEY

Wilson, R. M. (from C to B) 14 Evelyn Pl., Bloomfield, N. J.

NORTHWESTERN PA.

de Frees, Joseph H. (from C to B), 506 Liberty St., Warren, Pa.

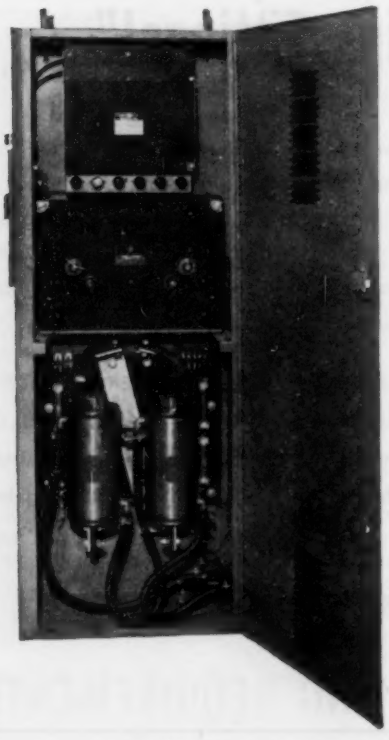
OKLAHOMA CITY

Simms, Howard N. (from C to B), 1217 S. W. 32nd, Oklahoma City 9, Okla.

PRECISION CONTROLS FOR RESISTANCE WELDING MACHINES

Redesign of its complete line of synchronous precision controls for resistance welding machines has been announced by the Control Division of the General Electric Co. All components in the new line, plus the control station, are compactly housed in one cabinet, making the control easy to install, service, and operate. It is designed for spot and projection welding on air-, fluid-, motor- and foot-operated resistance welding machines. Although arranged for mounting on the right-hand side of the welding machine, it may be placed on the floor, or on a nearby wall or balcony if floor space is at a premium.

The synchronous precision weld timer embodies a completely new design which operates with alternating-current circuits, exclusively. All rectification circuits have been eliminated. Special regulating tubes assure accurate and precise timing under conditions of reasonable voltage fluctuation. The weld time or heat time is adjustable from 1 to 30 cycles in one-cycle steps by an adjuster calibrated in cycles having the same frequency as the power supply.



Electronic heat control is stepless control for adjustment of RMS current over a current range of 20 to 100%, permitting accurate adjustment to meet precise welding procedure. The heat control adjuster is graduated directly in per cent of maximum RMS current.

Synchronous precision tempering control is required for welding air-hardenable materials. When welded in the normal manner, these materials sometimes become brittle at the welded spot. If the weld is tempered, however, the weld nugget will be made strong and ductile. A weld can be tempered by applying two pulsations of current, separated by a time known as "chill time," without removing the electrode from the work. The current magnitude and timing interval of the first pulsation provide sufficient heat to produce the weld; the second pulsation, the correct heat for tempering. A temper-no-temper switch permits operation as an ordinary spot-welder control or as a tempering control.

WESTERN METAL CONGRESS AND EXPOSITION, OAKLAND, CALIFORNIA SIX DAYS BEGINNING MARCH 22, 1947

More than 40,000 metals scientists, engineers and executives are expected to attend the 5th Western Metal Congress and Exposition which will be held in the two Oakland Civic Auditoriums in the San Francisco-Oakland-Golden Gate area for six days beginning March 22, 1947.

W. H. Eisenman, Managing Director of the Exposition and also national secretary of the American Society for Metals, stated that the estimate is based upon attendance figures of the last previous Western Metals Congress and Exposition held in Los Angeles in 1941.

"Current interest in the progress made in metal alloys, metals manufacturing and fabricating equipment and other phases of the metals industries is at a high point," Mr. Eisenman said. "Never before have we seen such a manifestation of interest in the field. Attendance at the recently held National Metals Congress and Exposition at Atlantic City showed without question that general interest in achievements of the field is at an all time high."

It was pointed out that further evidence of interest is the fact that more manufacturers of metals industries products are showing in 1947 than ever before in a Western Metal Show. Too, the technical programs already completed show more than 75 technical papers, lecture courses and round-table discussions, also a new high for this event.

Sixteen western divisions of technical societies are actively cooperating in program and other activities of the Western Metal Congress and Exposition. The list includes the American Society for Metals, sponsors of the event; The American Chemical Society; the American Foundrymen's Association; The American Industrial Radium and X-Ray Society; The American Institute of Mining and Metallurgical Engineers; The American Institute of Electrical Engineers; The American Society for Testing Materials; The American Society of Tool Engineers, Inc.; The American Welding Society; The Mining Association of California; The Northwest Electric Light and Power Association; The Pacific Coast Electric Association; The Purchasing Agents Association of California, Inc.; Society of Automotive Engineers; Western Oil and Gas Association and the American Petroleum Institute.

All technical sessions and other educational activities of the cooperating societies will be held in the Oakland Civic Auditoriums, the Auditorium Arena and the Auditorium Exhibit Hall, same buildings where the Exposition will take place.

The technical program will open its activities on Monday, March 24th, and will continue through Thursday, March 27th. Members of cooperating societies will attend sessions to be addressed by nationally renowned technical speakers. Daily meetings will begin at 9 A.M. and during the day until 5 P.M. and are expected to attract capacity audiences.

LANDGRAF JOINS ZAPFFE

Fred K. Landgraf, Jr., joined the Research Laboratory of Carl A. Zapffe, Baltimore, Md., on November 1st as Research Metallurgist investigating special problems. Educated at Lafayette College, Mr. Landgraf spent one year in production research with the Vanadiam Corp. of America and two years in the Research Laboratory of Lebanon Steel Foundries before enlisting in the Air Force immediately after Pearl Harbor. He joined the first Night-Fighter Overseas Unit and for three years served through the African and European Campaigns as Specialist in Airborne Radar, American and British.

RANSOME DISTRIBUTOR

Welding Equipment & Supply Co., 220 Leib St., Detroit, has been appointed by the Ransome Machinery Corp., subsidiary of Worthington Pump and Machinery Corp. a distributor for Welding Positioning and Turning Roll Equipment in the Eastern half of the State of Michigan.

President's Address to the Members of the American Welding Society

By W. F. Hess

WE of the AMERICAN WELDING SOCIETY gathered together at this Annual Meeting, are fortunate in having held this week our first full Convention since the War. It is particularly appropriate at this season of the year that we should consider the many other things for which we have reason to be thankful. Not the least of these is the fact that the War is over and that the bulk of our people can turn from the production of instruments of War to the peaceful pursuits which tend to build up the standards of living of our people and increase their happiness and satisfaction. We as a nation are fortunate that we have come through the strenuous tests of War without serious loss of our essential freedoms. We members of Technical Societies are fortunate that government and management are both taking a broader and healthier attitude toward fundamental research, which is the life blood of our industry and the assurance of its continued healthy existence.

The exigencies of War have forced upon us great progress in the improvement of the older welding processes and the development of newer adaptations. We are now in a position to apply many of these new developments for the benefit rather than the destruction of mankind. The improvement and mechanization of the welding processes has outstripped the rising cost of labor and permitted our industry to continue to offer to all other industries its principal hope of keeping the cost of products within the reach of expanding markets. The uses of welding in American industry are still far from approaching saturation. We of the AMERICAN WELDING SOCIETY still have a great missionary work to perform, in teaching the benefits of welding to management and to engineers who hesitate to step forward and sponsor new methods, or have a bad taste for welding as a result of earlier experiences when welding was in its infancy. It is strange how some oldsters fail to recognize that youngsters have grown up. Our membership has doubled in the past six years, and increased more than four times in the past ten years. There will obviously be a steadying period in the growth curve of our SOCIETY membership. This is to be expected when we consider that a large number of names have been added to our membership whose interest in welding was occasioned by the war production effort, and may be expected to be of a temporary nature. Any talk or thought of lean years ahead for the AMERICAN WELDING SOCIETY seems entirely unfounded, unless we fail miserably to grasp the opportunities which lie ahead.

At this time I should like to pay particular tribute to the splendid manner in which the various Committees of the SOCIETY have functioned during the past year. In connection with this Annual Meeting, Chairman David, and his Convention Committee, and the Program Committee deserve our particular congratulations and appreciation. For their effective functioning during the year the SOCIETY owes a debt of gratitude to Chairman Fraser and his Finance Committee, Chairman Sieger and his Membership Committee, Chairman Priest and his Constitution and By-Laws Committee, Chairman Gibson and his Committee on Code of Principles of Conduct, Chairman Pierce and his Technical Activities Committee, Chairman Kyle and his Educational Committee and Chairman Boardman and his Welding Handbook Committee. The remaining Committees have also functioned well.

The SOCIETY has been extremely fortunate in the quality of the service rendered by its full-time officers and staff. It is my hope and firm belief that the SOCIETY will continue to grow and function in such a manner as to provide even greater service in the future than it has in the past.

To the newly elected officers of the SOCIETY I give my best wishes for a successful year of operation. I trust that our new President, coming as he does from the West Coast, will be able to knit the entire SOCIETY together into an even more smoothly functioning, and effectively cooperating group.

SUMMARY OF ACTIVITIES OF THE AMERICAN WELDING SOCIETY

For Year Ending September 30, 1946

BY M. M. KELLY, *Secretary*

Putting its war accomplishments behind it, the SOCIETY turned its attention to the equally difficult task of serving a nation-wide industry in the reconversion period, and set its sights for the longer-range needs of the future. Although these change-overs are not as trying for a technical society as for the industry it serves, nevertheless, the same careful planning, and the same considered judgment, are necessary to develop workable and sound plans. These changes, while not spectacular, may be needed in every phase of the SOCIETY's activities—Research, Standardization, Meetings, Publications, Membership Activities, Finances, Educational Work and a host of lesser, but equally important, phases of our work. To accomplish these tasks has required changes in committee personnel, new committee appointments, the reorientation of others and the abandonment of some no longer found useful. The more important of these changes, and corresponding changes in the paid staff, will be mentioned briefly later in this report.

The SOCIETY emerged from its war period with a surprisingly small loss in membership—the first in its history. This past year seven local Sections had to be disbanded, while three new Sections have been organized, and one is in the throes of reorganization. A firm base has been developed from which growing can be resumed. The Membership Committee and the District Vice-Presidents are already at work.

Through the ever watchfulness of the WELDING JOURNAL Editor, restricted reports and papers, constituting results of research conducted by government and private agencies during the war, have been brought to the membership through the JOURNAL columns as rapidly as released—more will be forthcoming. Through our affiliation with the Welding Research Council, our membership received first-hand results of welding research conducted in university and industrial laboratories by the foremost scientists and research workers in the welding field.

Our standardization work has been expedited to meet needs of industry and effort has been made to have these standards adopted universally, as well as to educate our membership and others interested, in the proper use of the standards. The latter has been accomplished through publicity releases and talks before the Sections.

A third edition of the *Welding Handbook*, long postponed because of government restrictions on publications, is now well under way and it is expected that early in 1948, the new book will be ready for distribution. The aim of the new Handbook Committee is to give you in this book the most comprehensive and up-to-date welding data that is available anywhere. The book entitled *Welding Metallurgy*, very much in demand, is now undergoing revision and will probably be ready for distribution shortly. Other books are in the making.

Our Governing Board, realizing the need for the injection of welding in the curriculum of engineering schools, inspired our Educational Committee to concentrate on a study of current engineering school textbooks, to bring about suitable revision, and on programs that would convey to the minds of the educators and our future engineers, the important part welding plays in all branches of engineering, with a view to having more welding included in the engineering and metallurgical courses. As

a further move in the direction of encouraging and stimulating undergraduate interest the A. F. Davis Undergraduate Welding Award was established this past year under the administration of our Educational Committee and, through the generosity of the Lincoln Foundation, our educational books and standards, appear on the shelves of a large number of university libraries in this country and abroad.

Despite restricted travel, meetings of the highest calibre have been held by our Sections. These meetings served to keep you informed of improvement in technique and methods of production, as well as to provide opportunity for the exchange of ideas on problems of common interest.

A most cordial relationship has been established between our SOCIETY and the welding institutions of other countries. Through an exchange of literature, our SOCIETY is bringing these institutions up to date on welding developments in this country. By the same token our SOCIETY is made aware of what is being done in other countries. We have been fortunate in having many foreign representatives visit us this past year. In every instance, they received a warm welcome and many courtesies.

Our finances remain in a healthy condition. Due to the vigilance of the Treasurer, with the assistance of the Finance Committee, our planned activities to advance the science and art of welding and enhance the SOCIETY's prestige the world over, will go on uninterrupted.

Our accomplishments of this past year are summarized briefly below. Complete reports in some instances will be published in the Annual Year Book, or in ensuing issues of the JOURNAL. Others will be made available to members wishing to view them at Headquarters.

Meetings of the Board of Directors

During the year, five meetings of the Board of Directors were held, four in New York and one in Cleveland. No meetings of the Executive Committee were held. Since the beginning of the year, the Board's attention has been directed to improvement in the SOCIETY's organization, with a view to rendering greater service to our Sections, and to improvement in the membership structure, toward the end of raising the standard of the SOCIETY more in keeping with that of a professional society. Special committees were appointed to study these matters. The findings of the Committee on Organization resulted in the selection of H. O. Klinke to serve in the dual capacities, of Handbook Editor and Associate Secretary. The selection was based on the candidate's broad knowledge, length of experience and capabilities for handling the editing of the Handbook and his familiarity with Section operations, having served in the Sections' various offices right up to Chairman. It was found that his work could be divided so that sufficient time would be available in the early stages of the Handbook preparation, to visit with and service the Sections satisfactorily, and that while it might be necessary to curtail this service somewhat when the editing of the Handbook begins, upon completion of the Handbook, Mr. Klinke would be free again to serve the Sections effectively. In the interest of economy, this seemed to be the best solution.

Unfortunately, after a lapse of several months, it was found that Mr. Klinke was not available for the position. Steps are being taken to obtain someone with the required qualifications for this position, but in order not to cause the SOCIETY embarrassment, Mr. Klinke is functioning in the interim period and the results attained to date are recorded in other parts of this report. It is hoped that the matter can be settled shortly so that greater progress can be made in the desired directions.

The second special committee, with scope to determine if a professional or semiprofessional society is desired and to set up membership requirements in accordance with its findings, has not yet reported but it is expected that such report will be forthcoming shortly.

Consideration has been given to increasing the Sections' revenue from dues collections, as requested by some of the Sections. Action on this proposal has been delayed until the Associate Secretary and the District Vice-Presidents have had time to make a thorough study of the Sections' needs and arrive at some scale of refunding that is fair to all Sections. Pending recommendations of the Associate Secretary and Section Advisory Committee a moderate sum has been set aside to assist the weaker Sections in remote places, in meeting travel expense of an outstanding speaker. The Associate Secretary was vested with authority to act on the Sections' requests for assistance.

With the unanimous approval of the Board, G. S. Mikhalapov, Director of Research, Air Reduction Sales Co., was named 1947 Adams Lecturer, and the following members have been added to our Honorary Membership roll: E. H. Ewertz and H. S. Smith.

With the Board's approval, our SOCIETY has assumed responsibility for administering the funds and handling the Lincoln Gold Medal and the A. F. Davis Undergraduate Welding Award. Heretofore, the SOCIETY merely served as judges of award.

Further additions have been made to the staff and improvement in the SOCIETY's operations have been effected as a result of Board action.

Publications

Welding Journal.—Following a long-term policy, the size of the JOURNAL and the Research Supplement has been increased each year, during calendar year 1945 reaching an all-time peak. A comparative table of the number of pages published in 1945 with that of 1944, is shown below:

	1944	1945
WELDING JOURNAL	1230	1252
Research Supplement	656	672

Advertising revenue for the year 1945 also rose to an all-time peak and revenue from subscriptions increased.

Although the advertising revenue for the calendar year 1946 has held up fairly well, it is not expected to reach the peak volume obtained in 1945. The JOURNAL continues to show a fairly substantial profit on operations.

During the year a new department was added on "Current Welding Patents." There is prospect of adding an additional department on the technical activities of the SOCIETY.

The Welding Research Supplement is now regarded as one of the most outstanding technical journals the world over, and is widely quoted in all bibliographic summaries. All of the other departments of the JOURNAL have been maintained and most of them have been increased.

Welding Handbook.—The members of the Handbook Committee and the Editor have met regularly during the past year. A total of 33 out of 44 Chapters are complete as to Committee, including those to be handled by the Handbook Editor. The remaining 11 Chapters will be completed, as to Committee organization, in the near future.

The Handbook Editor has not traveled any as yet in working with his Committees but conferences have been held in New York with several of the Chapter Chairmen, outlining the scope and type of coverage for each Chapter. He has also attempted with each Chapter to stress a basic approach to the treatment of the Chapter which it is expected will yield a text that will be suitable as a reference and technical handbook. It is hoped that by next year a preliminary announcement can be made.

Other Reference and Educational Books.—Books which are now available or in the process of making, include revised edition *Welding Metallurgy, Practical Design for Welded Steel Structures, Guide to Weldability, Foreign Glossary of Foreign Welding Terms, Stress and Strain in Plastic Flow, The Problem of Fracture* and *Fracture of Metals.*

Foreign Libraries.—Some time ago A.W.S. made arrangements with the American Library Association to supply them with ten sets of THE WELDING JOURNAL, with the understanding that this association would distribute these ten sets most judiciously in response to requests from foreign libraries after the war. One condition was attached to this arrangement, namely, that A.W.S. would feel free to call upon the A.L.A. for assistance and guidance in handling requests which came to it direct. In accordance with this arrangement, A.L.A. to date has distributed five of the ten sets.

During the past year, A.W.S. has received quite a number of independent requests from abroad for copies of THE WELDING JOURNAL, on which favorable action was taken, where so advised by the A.L.A.

Membership

The nice gains in membership experienced these past few years because of the extensive use of welding on war work are now being offset somewhat by the sudden curtailment of government programs in shipbuilding and aircraft plants. It is expected, however, that the losses in mem-

bership sustained through reconversion will be regained in due course by increased activity in construction fields, such as, building, highway bridges, railroads, pressure vessels and the fabrication of ferrous and nonferrous sheet metal.

Realizing the opportunities ahead, many of our Sections have started work on well-planned programs, and the Membership Committee, also having foresight, has focused its attention on attractive promotional literature, membership ads in welding publications and house organs, the use of slogan "Join the American Welding Society" on stationery of our company members and the inclusion of membership ads in mailings of some of our large companies. We are beginning to profit from these programs.

Due recognition is given here to the splendid cooperation received this past year, and on behalf of the SOCIETY, gratitude is expressed to the editors of *Industry and Welding* and THE WELDING JOURNAL, for complimentary space devoted to the membership ads, to the companies that have prepared these attractive ads, to the companies that are using our membership slogan in one form or another and to the companies that are including the membership ads in their mailings. Gratitude is expressed also to the Secretary of our Publicity Committee and his associates, who have prepared the very attractive piece of promotional literature distributed recently. Finally, gratitude is expressed to the Sections, Membership Committee, its Advisory Group and to the Chairman, G. N. Sieger, in particular, who have given freely of their time in promoting interest in the AMERICAN WELDING SOCIETY.

A gain of 18% in new members during the past year was offset by a 27% drop in the rolls, making a net loss of 9%.

Gains and losses in the various classifications in terms of percentages are given below:

	Increase	Decrease	Net Loss
Sustaining Members	5½	13	7½
Full Members	17	22	5
Associate Members	18½	28½	10
Operating Members	11	68½	57½
Student	31½	47	15½

From the above, it is to be noted that our greatest loss is in the Operating classification due to the abolishment of this classification.

Membership statistics for the year ending September 30, 1946 are as shown below:

	A	B	C	D	E	F	Total
Total membership, Sept. 30, 1945	142	3146	4699	131	2	19	8139
Gain (new members, increases in classifications and reinstatements)	8	551	878	15	3	6	1461
	150	3697	5577	146	5	25	9600
Loss (resignations, cancellations because of delinquency and decreases in classification)	19	718	1353	90	..	9	2189
Total membership, Sept. 30, 1946	131	2979	4224	56	5	16	7411
Net changes during year	−11	−167	−475	−75	+3	−3	−728

Districts and Sections

It is gratifying to note that through the combined efforts of our District Vice-Presidents and local interested groups new Sections have been formed or reorganized in Dayton, Ohio, Spokane, Washington, and Long Beach, California.

Many Sections have been visited by their District Vice-President, some visiting every Section in his District, resulting in greater activity and improved operation. Vice-President of Western District reported that although many war production plants closed down, the influx of many new enterprises makes the outlook for SOCIETY expansion in that District very good. Good response for new speakers from this District has added a number of excellent talks to our current Speakers List.

The speaker circuit in effect at present has been operating so successfully that efforts are being made toward creating new circuits in other Districts, wherever practicable, thus enabling all Sections to receive the best talent available for their meetings.

The majority of Sections have been holding regular meetings successfully and several have joined the Technical Societies Council in their locality, entering into the activities of these Councils and participating in discussion of subjects of common interest.

Some Sections have resumed their specialized courses; others have conducted Question-and-Answer periods, while others have started again, plant inspections, all of educational value to the membership; entertainment features included Twenty-Fifth Anniversary Celebrations, Ladies Night, golf tournaments and gala reunions. With few exceptions, the Sections enjoyed a successful year.

Visits of Officers to Sections

It was the privilege and the pleasure of President Hess, this year, to address the following Sections of our Society: Philadelphia, New York, Boston, Mahoning Valley, Cleveland, Denver, Los Angeles, San Francisco, Puget Sound, Tacoma, Portland, Oregon, and New Jersey. Had not his plans been interrupted by having to undergo an operation he would have addressed also the Peoria, Wichita, Tulsa, Kansas and Oklahoma City Sections. In addition, the Secretary, in company with the JOURNAL Editor, had the pleasure of attending the Twenty-Fifth Anniversary Celebration of the Pittsburgh Section. She attended also the Annual Meetings of the Detroit and Washington Sections, the latter, with the Technical Secretary. During the year she visited with the Cleveland, Philadelphia and Chicago Section Officers. These visits have resulted in better understanding and more effective cooperation between the Sections and Headquarters.

The Associate Secretary has aided many of the Sections in solving their problems, through correspondence, and with the assistance of the District Vice-President, he has heightened interest in the Western Massachusetts Section. It is planned, during the coming year, to investigate welding activities and the SOCIETY's sphere of influence in other regions.

Finances

As a consequence of the later time set for presentation of the Financial Statement for the fiscal year ending Sept. 30, 1946, it is possible to report the year-end status, rather than that at the end of eleven months, as in previous years.

Current Assets at the year's end amounted to $168,554.88 and Current Liabilities were $30,542.43, leaving Net Working Capital of $138,012.45, as against $125,485.64 at the close of the previous year.

As was foreseen, the industrial dislocations that have followed the closing of the war have resulted in a decrease in membership amounting to a net loss of 728 members. This has meant a smaller income from membership dues, by $12,596.43, than was received in the previous year. The yield from advertising in THE WELDING JOURNAL also was less than in the previous year by $4736.10. There were offsetting, greater-than-anticipated yields from other sources so that the SOCIETY's total income was only $3799.26 less than that of the previous year.

Total Expenses also were greater than in the previous year by $30,077.28. More than 79% of this was in greatly increased costs of producing THE WELDING JOURNAL and of Technical Activity and Printed Matter. There were smaller increases in several other items of expense and decreases in a few items from the corresponding figures for the previous year.

On the year's operations there was a Net Excess of Income Over Expenses of $10,071.51. Because the SOCIETY's outlook for the immediate future is not completely clear, it is considered best to retain all of this excess in the current cash account rather than to transfer some of it to the Permanent Funds Reserve. It may be necessary for the proper handling of problems that may arise during the next year.

The Net Worth of the SOCIETY now stands at the highest level in its history. It amounted to $71,390.08 at the close of the fiscal year, an increase of $16,349.80 over the Net Worth at the close of the previous year.

The sum of $5000 was transferred to the Permanent Funds Reserve during the first half of the year. Also transferred to that Reserve was the usual mandatory 1% of gross income, which amounted to $1891.95. The total transferred to the Permanent Funds Reserve thus was $6891.95.

During the year, the Permanent Funds Committee invested $7500 in U. S. Treasury 2½% Bonds.

In accordance with resolution adopted by the Board of Directors, at its meeting on Feb. 6, 1946, the Bankers Trust Co. was made custodian of the SOCIETY's securities. On Feb. 27, 1946, in the presence of the Chairman of the Committee

on Permanent Funds and the Assistant Treasurer, the SOCIETY's securities, in the amount of $74,500, were turned over to the Bankers Trust Co. for safekeeping. Henceforth, the Bankers Trust Co. will assume responsibility for the safekeeping of these bonds and on due date, will clip bond coupons and deposit them to the account of the A.W.S. Committee on Permanent Funds, reporting the transactions to the A.W.S. at the time of deposit.

In addition to the securities recorded above, there is a cash deposit in the Reserve Fund accounts of $6240.52.

During the year the funds of the Welding Handbook Committee, which hitherto had been kept entirely separate, were merged with the General Funds of the SOCIETY. The amount thus taken over was $12,327.25.

An important change was made during the year in the SOCIETY's banking practices. Instead of keeping all cash resources in current accounts, the sum of $37,500 was transferred to six newly opened accounts in savings banks. The interest on these new accounts will constitute a small but welcome new source of current income.

The Annual Meeting cost the SOCIETY $6433.95, for which there was a partially offsetting income from the National Metal Congress of $1250.

The Finance Committee met once early in the fiscal year to discuss and approve the financial report for the previous year, to prepare the budget for the fiscal year ending Sept. 30, 1946, and to discuss a number of other matters pertaining to the general financial operations of the SOCIETY. At other times, matters as they came up were handled by the Committee either by correspondence or by telephone.

The Special Committee appointed to build up the Permanent Reserve Funds met once to consider reopening its activities which had been dormant because of unsettled industrial conditions. It was decided to await more settled conditions before reopening the program.

Meetings

Due to travel restrictions and overcrowded hotels, the 1945 Annual Meeting was limited to a one-day event. It was held at the Hotel Pennsylvania, New York. on October 18th. The meeting was staged in conjunction with the 25th Anniversary Dinner of the New York Section of A.W.S. which took place on the same date.

Only one general session was held at the Annual Meeting, during which medals and prizes were awarded and the Adams Lecture entitled "Selection of Steel for Welding" was presented by Dr. S. L. Hoyt, Technical Adviser, Battelle Memorial Institute. This was a morning session, which was followed by a luncheon. In the afternoon the usual Business Session and Directors' meeting were held.

By vote of the Board of Directors, the Program Committee, with the cooperation of the Publication Committee and the editor of THE WELDING JOURNAL, carried on a "Convention-by-Mail" and some success was achieved. Although some 53 papers were originally scheduled for this "Convention-by-Mail," actually to date only 37 papers were received and for all practical purposes, this closes the "Convention-by-Mail."

To a limited extent, A.W.S. participated with A.S.M. and other technical societies in the National Metal Congress and Exposition held in Cleveland, Ohio, Feb. 4–8, 1946. While no regular technical sessions of A.W.S. were scheduled, a Directors' meeting and several committee meetings were held. In addition, a number of the manufacturers had welding and cutting exhibits. This meeting, however, was not considered as the 1946 Annual Meeting of A.W.S.

On recommendation of the Manufacturers Committee, it was decided to hold the 27th Annual Meeting of the SOCIETY in Atlantic City, N. J., in conjunction with the National Metal Congress and Exposition, during the week of Nov. 17–22, 1946. Beginning early in the year, the Program Committee laid intensive plans to arrange for the best technical meeting the SOCIETY has ever held. As a result of this effort, it arranged for 24 sessions comprising a total of 84 papers. Throughout the entire Meeting, 3 simultaneous sessions were held each day, with the exception of Thursday and Friday afternoons. The papers varied from the most practical applications to the highly theoretical subjects based upon the latest researches.

In order to give every member of the SOCIETY an opportunity to present a paper if he chose to do so, a questionnaire was sent out to all. This, together with the usual effort of the Program Committee and the splendid cooperation of the Welding Research Council, has resulted in the program described briefly above.

The Program Committee has worked in cooperation with the Convention Committee and the Philadelphia Section. In order to provide for so many papers, a few changes in customary procedure have been made necessary. For example, the awarding of prizes and medals was shifted to the Annual Dinner.

Because of the postponement of the Annual Meeting to November, all Annual Meeting papers have been published in the October and November issues of THE WELDING JOURNAL, thus labeling two numbers as "Convention issues."

The Meeting has been the first one of full scale and length since before the war. All the former social activities, such as the President's Reception on Sunday afternoon and the Ladies' Entertainment throughout the week, were restored to the program. The Annual Dinner was an outstanding and well-attended affair.

For several years, A.W.S. has not had a booth at the National Metal Exposition. It has been decided this year to revive this activity. It is considered that if properly manned and operated, worth-while results should be obtained from this booth.

The success of our Meetings has been due largely to the energetic efforts of E. V. David, Chairman of the Convention Committee; E. Vom Steeg, Chairman of the Program Committee; and J. B. Tinnon Chairman of the Manufacturers Committee, and the members of these Committees, the local groups where the Meetings are held, and to the A.W.S. staff. Sincere appreciation is here expressed to all who contributed.

Separate Welding Exposition

The study of proposal that the A.W.S. sponsor a welding exposition, has gone on this past year uninterrupted. It is planned to devote the greater portion of a coming Board meeting to a discussion of the subject, in the hopes of reaching a conclusion favorable to the SOCIETY.

Time did not permit reporting result of discussion in this Report.

Publicity

The Publicity Committee has prepared 19 releases during the year, 12 of which were sent to the active list of trade and technical publications, 11 to the Local Sections and 5 to newspapers.

Annual Meeting Publicity.—A ten-point publicity program was prepared in detail for the 1946 Annual Meeting. The program was arranged to publicize the Meeting during three time phases: pre-Convention, Convention and post-Convention. The pre-Convention publicity included the sending of two notices to trade and technical magazines, one announcing the Meeting and a more comprehensive follow-up containing the complete program; a personal letter to a selected list of industrial executives in Atlantic City area; announcements for important newspapers within 150 miles of Atlantic City, and an announcement and the program to all members. The Convention publicity included the furnishing of releases on presiding officers, the Adams Lecturer and recipients of medals; the preparation and distribution of abstracts of papers presented at the Meeting and the arrangements for press interviews. Post-Convention activity comprised announcements of the new officers, publicity about the speakers and releases to home-town newspapers for officers and speakers.

Membership Interest.—The Publicity Committee has cooperated with the Membership Committee in the preparation of a four-page letter-size pamphlet to be used in a drive for new members. This pamphlet included a personal letter to prospective members, a graphical presentation of the SOCIETY's membership growth, data on the distribution of membership by occupation and the advantages the SOCIETY gives to its members. The Publicity Committee handled the production of the pamphlet and its bulk distribution to the Membership Committee, the Directors of the SOCIETY and to Local Sections.

Clipping Service.—After surveying the results of the clipping service received in 1945 the Committee decided to change the arrangement by using two new clipping bureaus, one for newspapers and the other for trade and technical magazines. As of Sept. 5, 1946, the SOCIETY has received a total of 39 clippings of newspaper releases and 106 clippings of trade and technical magazine releases. The Committee recommended that these clipping services be continued.

Gratitude is expressed to the Publicity Committee, to its Chairman, T. C. Feth-

erston, and to J. L. Stover, who served as Secretary of the Committee for several years but found it necessary to resign early in the year; to his successor, John Vreeland, who also found it necessary to put aside this work because of a change in business assignments, and to C. L. Combes, who was next appointed and served most of the year. They have all brought to their work the great interest of the SOCIETY and a zeal for furthering its objectives, and in addition, a professional competence and understanding that have made it possible for them to accomplish the work undertaken in behalf of the Committee with dispatch and real efficiency.

Education

The Committee under the chairmanship of Professor Kyle met in Cleveland on Feb. 5, 1946, and in New York on May 13, 1946. The remaining business here reported was done by correspondence.

The *A. F. Davis Undergraduate Welding Award Program* has been arranged, a brochure written and the copy for the certificate of award prepared. The Jury of Award was chosen and is made up as follows: Dr. W. L. Warner, Harold S. Card and K. V. King. The Committee has revised the announcement for the next contest year in hopes of increasing the number of contestants.

A list of *Educational Movies on Welding* in the fields in which welding is introduced to engineering school students has been carried on and the publishers have been sent the comments of the Committee on the books submitted. This survey will continue and the Committee has offered to review manuscripts of new books and revisions with the view to offering constructive suggestions to the authors regarding the treatment of welding.

Before preparing a *Curriculum in Welding Engineering* or descriptions of *Courses in Welding* to be sent out over the signature of the President of A.W.S., the Committee feels that a detailed survey should be done of the courses and methods now in use by the engineering schools. This survey is now being organized and letters requesting information will be sent to the Deans of Engineering of accredited colleges and universities soon.

A draft of a statement regarding *Training and Qualifications of a Welding Engineer* is being prepared in line with those requirements now being met by civil service appointees in other engineering fields.

At a meeting of the Board of Directors of A.W.S. in New York on June 20, 1946, it was the consensus of opinion that the Educational Committee feel free if the occasion warrants to function in any manner not conflicting with the work of the Technical Committee on Minimum Requirements of Instructions for Welding Operators in the field of vocational or trade school work.

Awards

The Committee on Awards under the chairmanship of A. M. Candy, has given careful consideration to the various duties assigned to it and has presented to the Secretary of the SOCIETY its nominations for Adams Lecturer, Miller Medallist and Lincoln Medallist. The following selections have been made to date:

Samuel Wylie Miller Memorial Medal—J. F. Lincoln

Lincoln Gold Medal—H. E. Kennedy for his paper entitled "Some Causes of Brittle Failures in Welded Mild Steel Structures"

Honorable Mention—George G. Luther, Clarence E. Jackson and Carl E. Hartbower for their paper entitled "A Review and Summary of a Weldability Testing Carbon on Low-Alloy Steels"

1947 Adams Lecturer—G. S. Mikhalapov

The Jury of Award of the R.W.M.A. 1946 Prize Contest has selected as this year's winners the following:

Industrial:

1st prize—Julius Heuschkel, Westinghouse Electric Corp., E. Pittsburgh, Pa., for his paper entitled "Selecting Spot Welding Schedules for Low-Carbon Steels"

2nd prize—J. J. Riley, Taylor-Winfield Corp., Warren, Ohio, for his paper entitled "Variation in Quality of Spot Welds in Low-Carbon Steel Over a Range of Welding Variables"

3rd prize—R. W. Bennett and R. D. Williams, Battelle Memorial Institute, Columbus, Ohio, for their paper entitled "The Flash Welding of Hard-Drawn High-Carbon Steel Wire"

University:

1st prize—R. C. McMaster and N. A. Begovich, California Institute of Technology, Pasadena, Calif., for their paper entitled "Instrumentation of the Spot Welder and Investigation of the Spot Welding of .091-.091-In. 24ST Alclad Sheet"

2nd prize—W. F. Hess, W. D. Doty and W. H. Childs, Rensselaer Polytechnic Institute, Troy, N. Y., for their paper entitled "The Spot Welding of NE-8715, NE8630 and SAE4340 in the 0.125 In. Thickness"

On recommendation of the Jury of Award appointed by the Educational Committee, the following have been selected as winners in the A. F. Davis Undergraduate Welding Awards:

1st Prize:

Authors—Stephen Mikochik and Joseph S. Ward, Jr., New York, for their paper entitled "Welding in Bridges"

Publication—*Manhattan Engineer*, June 1946, Manhattan College, New York.

2nd Prize:

Author—Lee Ragsdale, Jr., Durham, N. C., for his paper entitled "Welded Homes for Millions"

Publication—*The Dukengineer*, May 1946, Duke University, Durham, N. C.

Public Relations

During the past fiscal year the Public Relations Committee under the chairmanship of H. F. Reinhard, has been called upon to consider and make recommendations with respect to several matters as follows:

1. *Legal Aspects of Standardization.*—This study was prompted by a paper on the subject delivered at a meeting of the "Conference of Staff Executives of A.S.A. Member and Associate Member Bodies" on March 7, 1946, by A.S.A. counsel, James V. Hayes. The paper dealt with the relationship of standardization to the Anti-Trust Laws. Your Committee concluded, and so reported to the Technical Activities Committee, that all standards developed by the A.W.S. had a sound basis in engineering, health or safety and that since they furthermore constitute advice or recommendations to industry with any company or party having complete freedom to use them or not, there was little chance of their legality being successfully challenged.

2. *Proposed A.W.S. Advisory Committee to New York City Board of Transportation on Welding of Subway Structures.*—The question submitted to the Public Relations Committee by the A.W.S. Board of Directors was whether the A.W.S. should appoint an Advisory Committee to the New York City Board of Transportation and/or whether the staff of the A.W.S. should act in an advisory capacity. The opinion of the Public Relations Committee was that neither should be done. It was believed that should the A.W.S. do so it would be held responsible for the results obtained and in addition the A.W.S. would be likely to get into commercial involvements. The recommendation to the Board of Directors was that if and when the New York City Board of Transportation desires advice on any specific subject, including welding technique, the A.W.S. should limit itself to supplying the Board of Transportation with such A.W.S. technical literature bearing on the subject as has been prepared and approved by the A.W.S. through its normal procedures. The Public Relations Committee cooperated with the A.W.S. Technical Secretary in preparing a letter addressed to the Chief Engineer of the New York City Board of Transportation advising of the above decisions.

3. *Recognition of Welding Engineers.*—This subject involved the apparent fact that many men with scant knowledge of welding were claiming the title of "Welding Engineer" and that in many cases the inability of these engineers due to insufficient experience and training had led to sharp criticism on the part of both industry management engaged in contracts involving welding, and on the part of Government contracting officers. The thoughts of the Chairman of the Public Relations Committee and those with whom he discussed the matter were duly transmitted to the A.W.S. Board of Directors, who considered the matter at one of their meetings. The Directors have not yet arrived at any final decision, but they arrived at the opinion that everything possible should be done to protect the reputation of the welding industry and to uphold the properly qualified engineer in the welding field. They agreed that qualification and the issuance of certificates to welding engi-

neers was outside the scope of a technical or professional society. They submitted the matter to the Educational Committee with a view toward setting up standard qualifications for welding engineers that could, if desired, be accepted by colleges, universities and industry.

4. *Kentucky House Bill No. 89.*—An Act relating to the use of metal welding apparatus. As introduced this Bill proposed that all persons or corporations operating a factory or workshop where the welding, cutting or heating of steel, iron or other hard and malleable metal is done by the use of an electric or acetylene torch or apparatus shall, for the protection of their employees using such torches or apparatus, provide at least one assistant or helper to aid and assist each of such employees while engaged in such work, except that one assistant or helper could serve two employees using such torches or apparatus where such torches or apparatus were being used in close proximity, clearly visible and readily accessible to the assistant or helper. Severe penalties for violation of the provisions of the Act were specified. The Bill was later acceptably amended so as to necessitate a welder's helper only where the welding, cutting or heating was to be performed inside of metal boilers and closed tanks, but it failed to progress to passage and died with the adjournment of the legislative session.

Code of Ethics

The subject of a set of principles which would be a rule of conduct for members of A.W.S. has been under consideration by the Committee on Code of Principles of Conduct for a considerable time. The code proposed by the Committee, under the Chairmanship of A. E. Gibson, and approved by the Board of Directors on June 20, 1946, was based on one accepted by four other national engineering societies.

It is the thought of the Committee that the code need not necessarily be final. Further consideration and experience will, no doubt, suggest changes which can be made in the future. It was the aim of the Committee to propose a code of ethics which any conscientious engineer would willingly subscribe to in order that the profession be maintained on a high ethical plane.

Code adopted by the Directors was published in its entirety in the July 1946 WELDING JOURNAL.

Constitution and By-Laws

The By-Laws Committee of A.W.S. under the Chairmanship of H. M. Priest has reviewed proposed By-Laws for the following Sections of A.W.S.: New Orleans, La., Tacoma, Wash., Dayton, Ohio, and Inland Empire, Spokane, Wash.

An amendment to Article XVI, Section 2, was proposed and adopted by the Board of Directors, providing that all persons authorized to sign checks and other financial documents and those handling the monies of the SOCIETY shall be bonded.

A petition signed by sixteen qualified members requested an amendment to Article XX, Section 1, to provide that no letter ballot should be submitted to the membership in the months of May, June, July and August, This amendment was approved by the Directors.

Last July the SOCIETY was presented with the problem arising from the death of a nominee for one of the District Vice-Presidents and as a result the Committee proposed the addition of Section 1-d to Article IX which would cover any vacancy occurring in the list of nominees for offices in the SOCIETY. This section was approved by the Board.

A few minor changes throughout the By-Laws were made during the year and these, together with the ones just mentioned, were submitted to letter ballot of the membership on April 26, 1946. They now stand approved.

During the year it was learned that the National Metal Show would be held in Atlantic City in November. Postponing this Show from October, raised a question as to the time of holding the Annual Meeting of the SOCIETY. The By-Laws require the Annual Meeting to be held between September 1st and October 31st, and heretofore the Metal Show has always been held in the month of October. Two proposals were made by the Committee. The first, to hold the Annual Meeting in New York late in October and adjourn it, without transaction of business, to Atlantic City the week of November 17th. The second, to amend the By-Laws to extend the time limit within which the Meeting may be held. The Board of Directors adopted the first proposal and tabled the second.

ACKNOWLEDGMENTS

In addition to recognition of the work of certain committees given above, special commendation is due the Chairmen and Committee Members of the Constitution and By-Laws, the Publication, Public Relations, Education, Awards, R.W.M.A. Awards, Committees, the Technical Activities Committee and its Technical Committees, and the officers of the Welding Research Council, all of whom have given unstintingly of their time in behalf of the SOCIETY.

The past year's achievements are possible only because of the loyal support and cooperation of the Sections, Committees, Sustaining Members, JOURNAL Advertisers and Headquarters Staff, and because of the guiding influence of the National Officers. Our thanks are extended to all.

(Report of Technical Activities & Research Will be Published in the February Issue)

(*Continued from page 88*)

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NOT IN SECTIONS

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